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A Revision of the North American Species of *Typhlocyba* and its Allies (Homoptera, Cicadellidae)[1]

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ABSTRACT: This revision includes descriptions of the Typhlocybid genera *Henribautia, Ribautiana, Ossiannilssonola, Typhlocyba, Empoa, Edwardsiana,* and a new genus *Mcateeana* (Homoptera, Cicadellidae), with redescriptions of all of the known North American species of each, keys to the species, new illustrations, new host records, new distribution records, and descriptions and illustrations of the following twenty-two new species: *Henribautia beameri; Ribautiana multispinosa, R. parapiscator; Ossiannilssonola bangsoni, O. knulli, O. mcateei, O. rossi; Empoa acericola, E. caryata, E. elmata, E. latifasciata, E. platana; Typhlocyba alabamaensis, T. attenuata, T. inflata, T. medleri, T. transviridis; Edwardsiana dejecta, E. delongi, E. nigripennis, E. projecta, E. pseudocommissuralis.*

Typhlocyba jacobii nom. nov. for *T. duplicata* Jacobi, nec *T. duplicata* McAtee is proposed, and *Ossiannilssonia* Young and Christian, nec Lambers, is replaced by *Ossiannilssonola* nom. nov.

Edwardsiana plebeja and *E. frustrator* are recorded for the first time as occurring in North America.

New synonymy is as follows: *Ribautiana unca* (McAtee) (= *Typhlocyba surda* DeLong and Johnson); *Ossiannilssonola australis* (Walsh) (= *Typhlocyba nicarete* McAtee), *O. danae* (McAtee) (= *Typhlocyba eurydice* McAtee), *O. appendiculata* (Malloch) (= *Typhlocyba gillettei* var. *sellata* McAtee); *Typhlocyba rubriocellata* Malloch (= *Typhlocyba escana* Ross and DeLong), *T. persephone* McAtee (= *Typhlocyba lancifer* McAtee); *Empoa albicans* Walsh (= *Typhlocyba cymba* var. *pallens* McAtee); *Edwardsiana australis* Froggatt replaces the name *Typhlocyba froggatti* (Baker).

TABLE OF CONTENTS

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40—6490

INTRODUCTION

The purpose of this revision is to define more clearly each of the genera of the Typhlocyba Complex which contain species occurring in North America, and to present clear descriptions, illustrations, keys, and new synonymy for the known North American species of these genera of leafhoppers.

The genera of the Typhlocyba Complex included are as follows: *Typhlocyba, Empoa, Edwardsiana, Ribautiana, Henribautia, Ossiannilssonola* and a new genus *Mcateeana.*

New descriptions and illustrations of the male genitalia are given for nearly all of the previously described species, for two European species not previously recorded from North America, and for twenty-two new species.

New host records, biological notes, and locality records have been included under each species subsequent to its description, and for many species these add greatly to our knowledge of the habits and distribution of the species.

HISTORICAL ACCOUNT

The first revision of the species now placed in the Typhlocyba Complex was made by W. L. McAtee in 1926, who gave descriptions of the known North American species, all of which were then included in *Typhlocyba*, and described twenty-three new species and sixteen new varieties, with figures of the male genitalia for each species. The descriptions of two European species were also included although no North American specimens of these species had been seen. Much of the work included in this revision was accurate, but due to insufficient material to work with, lack of proper equipment, or to insufficient time, a number of inaccuracies occurred.

Since McAtee's revision a number of papers, which have added to our knowledge of the genus *Typhlocyba*, have appeared in various parts of the world. In 1928, Edwards moved the British species of *Typhlocyba* into the genus *Anomia* Fieber, and in 1929 Jazykov (Zachvatkin) proposed the genus *Edwardsiana* with *Cicada rosae* Linnaeus as the type species. Ribaut redescribed the French species of the Ulmi and Rosae Groups in 1931, with the description of several new species. The Oriental species of *Typhlocyba* were described by Matsumura in 1931-32, but without descriptions of the internal male genitalia. Wagner reviewed the species for Northern Germany in 1935, while in the same year Ossiannilsson reviewed the *Typhlocyba* species occurring in Sweden. In 1936 Ribaut redescribed all of the French species of *Typhlocyba* with illustrations of the male genitalia for each. Jacobi described a number of species of *Typhlocyba* from Lombok Island and adjacent islands in 1941.

The British species were brought up to date by China in 1943, who redescribed those species not considered by Ribaut (1936). In 1946 Dlabola recorded four species new to Bohemia. The genus *Ribautiana* was proposed in 1945 (1947) by Zachvatkin, along with the descriptions of new species of *Edwardsiana*. In 1949 Linnavouri described several species which had not been previously recorded for Finland. In 1950 China listed the British species, giving recognition to the genera *Edwardsiana* and *Ribautiana*, and in the same year Dlabola (1950) revised the leafhoppers from central Europe in Melichar's Collection, listing the species of *Typhlocyba* in the collection and indicating previous misdeterminations.

While this work was going on in other parts of the world, work was continuing on the North American species as well. New species were described by a number of workers: one by DeLong

(1926), one by Osborn (1928), one by DeLong and Davidson (1934), one by Ossiannilsson (1936), six by DeLong and Johnson (1936), one by Medler (1942), three species and one subspecies by Beamer (1943), six by Knull (1944), two by Knull (1945), and five by Ross and DeLong (1949). In 1949 a list of synonyms and references for another European species, of economic importance to cultivated prune, was made by Oman (1949a). Two new introductions of European species were reported recently, one in 1949 by Ross and DeLong, and the other by Andison, 1950.

With this increase in the number of North American species, some of which were known to be synonyms of previously described species and others whose identity was held in question, it was imperative that a revision be made in order to clear up the identity of all of the known species. While undertaking the revision of this genus the author has tried to use those methods which would permit the most accurate observations, and has included illustrations of those structures which best characterize the species.

Since the work on this genus was begun, the genera *Henribautia* Young and Christian, and *Ossiannilssonia* Young and Christian, have been segregated from *Typhlocyba* (see Young, 1952). The study of additional material subsequent to the completion of that paper has led the author to regard the species *sexnotata,* previously placed in the genus *Ossiannilssonia,* to have characters which justify the establishment of a new genus in which it has been placed.

Further consideration of the species of *Typhlocyba,* which on the basis of aedeagal structure appeared to be intermediate between the species in the Rosae Group and other species of *Typhlocyba,* has led the author to believe that the absence of atrial processes in such species as *T. tortosa, T. persephone, T. niobe,* and *T. sollisa* is due to a fusion of these with the aedeagal shaft, as is partly seen in *T. athene.* In species of the Rosae Group there is no indication that atrial processes have ever existed. When considered from this aspect, species of the Rosae Group are seen as having the aedeagus fundamentally different enough to set them off from *Typhlocyba* as a separate genus (*Edwardsiana* Zachvatkin). The group of species near and including *querci* Fitch has, on the basis of the structure of the aedeagus and pygofer, also been recognized as a genus distinct from *Typhlocyba* and has been segregated as the genus *Empoa* Fitch.

Ossiannilssonola, nom. nov.

The name replaces *Ossiannilssonia* Young and Christian *in* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, July 1, 1952, p. 97 (*nec* Lambers, Ent. Tidskr., vol. 73, no. 1-2, May 10, 1952, p. 41).

Typhlocyba jacobii nom. nov.

The name *Typhlocyba duplicata* Jacobi (Jacobi, 1941, nec. *Typhlocyba duplicata* McAtee, 1926) is here replaced by the name *Typhlocyba jacobii.* See *Ossiannilssonola duplicata* (McAtee) p. 1146.

During the time spent working on this revision, it was possible for the author to study type specimens and determined specimens in the following collections: the Illinois State Natural History Survey Collection, Urbana, Illinois; the Colorado Agricultural and Mechanical College Collection, Ft. Collins, Colorado; the U. S. National Museum Collection, Washington, D. C.; and the private collection of Dr. D. M. DeLong, Columbus, Ohio. In addition to these, type material in the Snow Entomological Collections of the University of Kansas was available for study, and type specimens were loaned for study by the Canadian National Collection, and by Mrs. J. N. Knull from her personal collection.

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ville, Florida; W. J. Gerhard, Chicago Natural History Museum; and J. R. Eyer, New Mexico College of Agriculture and Mechanical Arts.

GENITALIC CHARACTERISTICS

The genitalic structures of the male have been found important in distinguishing genera as well as species of the Typhlocyba Complex. The characteristic genitalic structure has been found to be generally constant for each species, and has proven to be reliable for use in the determination of species.

Although the form of the styles, connective, and male plates is generally uniform for all of the species of some genera, in other genera these structures are sometimes specifically distinct.

The shape of the aedeagus shows the greatest degree of modification, and has proven to be the most useful structure for grouping the species comprising different genera. The form of the aedeagus is equally useful in distinguishing between species within a genus.

The shape of the pygofer, though not as useful for generic distinction because of its wide diversity of form in some genera, is in these genera almost as important as the aedeagus for helping to distinguish between species within the genus.

For a concise summary of the relations of the male genitalic structures to each other, in the Cicadellidae, the reader is referred to Oman (1949b), pp. 22-23.

BIOLOGICAL NOTES

A number of interesting observations of the habits of some of the species collected have been made by the author while collecting.

Population shifts during the day were noticed for several species, and appeared to be caused by difference in temperature, difference in light intensity, or a combination of both of these factors. During the mornings in early June, adults could usually be found in greater abundance on those branches upon which the sun was shining, while they were seldom found on shaded branches. Shortly before noon, as the temperature began to rise, the adults were found to have shifted to the shaded lower branches. In the warm afternoons they were found in greatest abundance on branches on the shaded sides of the trees. Species living on small trees and shrubs were found in greater abundance along the edges of woods where the sun shone on the host plants, while in densely shaded areas only a few specimens could be found.

When disturbed from the branches, it was found that most species would fly to dark objects such as the bark on the trunk of trees,

stones, or to the ground. Species living in thickets were found to fly deeper into the thicket, or toward the ground when disturbed. In one instance, while collecting on *Quercus macrocarpa,* it was found to be more profitable to beat the lower branches of the trees with the net handle and to aspirate the insects from the tree trunks than to attempt to use the bag in the dense foliage. When returning to the leaves after having been disturbed, the insects usually alight on the under surfaces of the leaves. In collecting species which are not abundant or are not easily disturbed, when the branches are within easy reach it is sometimes possible to aspirate the insects from the undersurfaces of the leaves before beating. A large number of specimens were taken from *Acer saccharum* in this way, being easily seen from beneath, appearing as dark spots on the translucent light green leaves. This method was found to be most effective for collecting *Edwardsiana candidula* from the fastigiate form of *Populus alba,* after beating had proven ineffective.

On warm humid nights the collection of Typhlocybid leafhoppers at light was found to be particularly good. While collecting in Milwaukee, Wisconsin, on June 27, 1950, a warm humid night when thousands of specimens of species of *Empoa* were seen, it was found that certain colors of neon lights were more attractive than others. Few specimens were found at yellow, some at red, more at white, while most specimens were found around green and blue lights. Blue light was apparently more attractive than green.

Serious host injury was observed in only a few cases, the greatest injury seen being that done by *T. hockingensis* on a species of *Viburnum* used in Milwaukee County parks as an ornamental shrub. Damage was particularly heavy in some areas, with leaves nearly white from feeding injury, while in other areas only slight injury or none was seen. The host plant was quite abundant, and usually planted in hedgelike rows, which made it possible to easily see the irregularity of injury. Similar irregularity of host injury was observed on *Quercus alba,* caused by several species of leafhopper, but principally by *Ossiannilssonola berenice* in association with *O. danae* and *O. australis.* Noticeable injury was seen on *Acer saccharum* caused by an association of several species, but primarily by *Typhlocyba niobe* and *T. persephone.*

This factor of irregularity of population distribution makes it possible to collect large numbers of specimens in one place while in another place under apparently the same conditions specimens of the same species are rare.

Males were found to begin reaching maturity several days be-

fore females of the same species, so that early collections frequently contained a large majority of males. Within one week after the first males were taken, about equal numbers of both sexes were found, but after two more weeks the majority of specimens found were females. Observations made on *Typhlocyba modesta* showed that this pattern was not followed, but that a ratio of nearly equal numbers of both sexes was maintained for several weeks before the population became predominantly female in composition. Observations on *Typhlocyba persephone* showed a rapid change to an all female population within about two weeks, and after four weeks it was impossible to find even a single female specimen in places where there had previously been an abundance of specimens.

The only species observed by the author to have a second generation were *Typhlocyba modesta, T. hockingensis,* and *T. melite.* Other species have been observed to have more than one generation a year by other workers, but populations of some of these species were so small that it was impossible to be certain whether a second generation had developed. Some of the species observed could not possibly have had a second generation on the host that the first generation was observed to feed on, because the leaves of the host withered and dropped before a second generation could have developed.

During the process of maturing, adults of some of the species of *Ossiannilssonola* and *Empoa* pass progressively through several color stages, with the color markings appearing to increase in extent and in intensity so that specimens killed at different stages of this process are marked to greater or lesser degree. Another factor influencing coloration which appears to be independent of the maturing process controls the ultimate extent of color on the mature adult. A more complete discussion of coloration is given in the description of the genus *Empoa,* and problems which concern other species are discussed in the color descriptions of these species.

Because of progressive coloration, and because male and female insects begin emerging at different times, male and female specimens taken at the same time often appear to be differently marked, the females being usually much lighter in color than the males with which they are taken. When fully colored specimens of both sexes are compared there is no color distinction between them.

Eye color has sometimes been referred to in the descriptions of light colored species. This color is caused by the migration of dark color pigment in the iris cells of the compound eye (Wigglesworth, 1947, pp. 113-115). When the insect is in a dark place the dark pig-

ment moves toward the surface of the eye, but when exposed to the light the pigment moves away from the surface of the eye. Because of this movement of pigment it has been possible for the author to collect specimens of one species showing both light and dark colored eyes by collecting on both shaded and sunny sides of a single tree, or by collecting at different times of the day. Specimens collected at night are frequently dark eyed when they come to the light, but the eye color becomes lighter as they remain at the light for some time.

TECHNIQUE

A particular type of net was found to be more efficient in collecting the insects studied than were the types commonly used for collecting leafhoppers. Since all of the species collected live on trees or bushes, a durable net bag was needed. A heavy canvas beating net was found to be impractical because it could not be moved rapidly enough, did not collapse quickly enough, and did not let in sufficient light. After testing several kinds of net bags, a fine-meshed nylon bag was found to be best suited for this type of collecting. Because most of the species collected were light colored, it was found that a bag dyed navy blue permitted them to be seen more easily, and they appeared to be less active than in a light colored bag. The bag was also pointed to restrict these rather active insects to a smaller space from which they could be aspirated more easily.

Most of the species studied were particularly fragile, and in order to remove the abdomen for dissection without detaching the specimen from the point, or injuring its wings, the paper point with the insect attached was removed from the pin and placed inverted on a piece of sheet cork. This exposed the abdomen in ventral aspect so that it could easily be separated from the thorax by a slight pressure with the point of the pin at its base.

Less heavily sclerotized specimens and those used for illustration were stained with acid fuchsin to show differences in sclerotization and to bring out obscure details.

Dissections were held stationary for drawing by means of a small amount of petroleum jelly placed on the slide before adding the glycerine. Dry slide mounts of the wings were used for making illustrations of the wings.

Drawings of the pygofer, plates, and head represent a magnification of 60 times actual size; drawings of the aedeagus, styles, connective of the male, and eighth abdominal sternite of the female, 120 times; drawings of the wings 56 times.

SYSTEMATIC ACCOUNT

Introduction to the Typhlocyba Complex

Most of the species included in the genus *Typhlocyba* prior to the segregation of the genera included in this revision were placed in this genus on the basis of wing venation as found in the type species, *Typhlocyba quercus* (Fabricius), the hind wing having two open apical cells, the fore wing with the inner and outer apical cells short and not attaining the wing apex, and the third apical cell of the fore wing triangular and usually stalked. Some of the species included in the genus differ from the type species in having the third apical cell of the fore wing quadrate and not stalked. The North American species with rare exceptions agreed with the type species in wing venation.

In recent interpretation of the genus *Typhlocyba* the structure of the male genitalia has been regarded as more significant than wing venation as a generic character, resulting in the segregation of groups of species from *Typhlocyba* as genera (Zachvatkin, 1939, 1947; Young, 1952). This change in generic concept has brought about a need for restudying the species of *Typhlocyba* to determine their generic status on the basis of the male genitalia. It is the opinion of the author that when this has been done for the species from other regions, additional new genera will be added to the Typhlocyba Complex.

The following systematic account includes only those genera of the Typhlocyba Complex which occur in North America.

Key to the Genera of the Typhlocyba Complex

1. Crown with median length equal to median length of pronotum or nearly so; ocelli present; pygofer without group of macrosetae near basal angle of male plate. (Pl. LXXIII, fig. 1), *Henribautia* p. 1115

   Crown with median length much less than median length of pronotum; ocelli rarely present; pygofer usually with macrosetae near outer basal angle of male plate 2

2. Aedeagal shaft reduced to a flattened membranous structure occurring between a pair of arms formed by longer forcipate atrial processes; plate without macroseta at outer basal angle. (Pl. IV, fig. 1) . . . . . *Ossiannilssonola* p. 1132

   Aedeagal shaft strongly sclerotized or absent, not so enclosed; plate with macroseta at outer basal angle 3

3. Aedeagal shaft absent, atrial processes fused at base, branched near apex. (Pl. I, fig. 4) . . . . . *Mcateeana* p. 1130

   Aedeagal shaft present, heavily sclerotized, atrial processes when present not branching 4

4. Mesal margin of style with distinct preapical angular protuberance. (Pl. II, fig. 1) ..... *Ribautiana* p. 1119
   Mesal margin of style without distinct preapical angular protuberance 5
5. Aedeagal shaft with three pairs of apical processes and three broad, thin plates arising from anterior margin. (Pl. LXXXVIII) ..... *Empoa* p. 1187
   Aedeagal shaft with less than three pairs of apical processes or none, rarely with one thin plate arising from anterior margin .. 6
6. Aedeagal shaft with two pairs of apical processes, frequently one or both pairs branched; without atrial processes; aedeagal apodeme a slender arm nearly two thirds the length of shaft, *Edwardsiana* p. 1208
   Aedeagal shaft with one pair or without apical processes; usually with atrial processes present; aedeagal apodeme usually laterally broadened, less than two thirds the length of shaft, *Typhlocyba* p. 1160

GENUS HENRIBAUTIA Young and Christian

(Pl. LXXIII, figs. 1, 2, 3)

Henribautia Young and Christian, *in* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, pp. 96-97.

Type of the genus, *Typhlocyba nigricephala* Beamer, by original designation.

Fore wings.—Inner and outer apical cells short, not attaining wing apex; second apical cell much broader at apex than at base; third apical cell petiolate; wing apex somewhat oblique; apical half of wing having a number of transparent areas scattered along the cross veins and in apical cells. (Pl. LXXIII, fig. 1h).

Hind wings.—Vein 1V branching from vein 2V near its midlength; submarginal vein absent at wing apex; both apical cells open apically; posterior branch of R fused with apical portion of vein M_{1+2}; basal half whitish hyaline, apical half fumose with veins brown. (Pl. LXXIII, fig. 1h).

Genital capsule.—Male plate, in ventral aspect, broadened on basal half, abruptly narrowed near middle of length to narrow upturned apex; in lateral aspect with single macroseta near outer basal angle of male plate, and a few small setae on apical half; pygofer, in lateral aspect with numerous small setae scattered over ventral half of disc, completely without macrosetae, dorsal posterior half of disc covered with numerous awl-shaped spines, posterior margin slightly inrolled, differentially sclerotized area near base of plate, posterodorsal margin with row of small setae; anal hooks wanting.

Internal male genitalia.—Style narrow, gradually tapered and curved laterad on apical half, with preapical triangular protuber-

ance on inner margin, with one or few setae on outer, and several alveoli on inner margin near middle of length; connective triangular to Y-shaped, the stem broad, aedeagal articulation subterminal; aedeagus without preatrial arm, apodeme simple, well developed, shaft slender, elongate, with paired apical processes.

Female.—With posterior margin of eighth abdominal sternite as in *H. nigricephala.* (Pl. LXXXVII, figs. 2a, b).

Head well produced medially, conical, median length of the crown greatly exceeding length next the eye particularly in female, nearly, or quite as long as, but narrower than pronotum, crown sharply rounded to the slightly convex face, contour divergent from the line of dorsum; ocelli present, situated on the margin between crown and face, distant from compound eyes; pronotum with lateral margins divergent posteriorly, posterior margin scarcely emarginate; pleural portion much broader than the ocellocular area; head, pronotum, and scutellum black to dark brown, face yellow ventrad of antennal pits, abdomen black to dark brown, male plates yellow with apices brown.

The known distribution of this genus is the southern United States from Mississippi westward to New Mexico.

KEY TO THE SPECIES OF HENRIBAUTIA

1. Vertex of head brownish black with only ocelli white; fore wings with basal half white to yellow-orange and meeting black-brown apical half in a transverse line, a small bilobed black mark along scutellum ..... *nigricephala* p. 1116
   Vertex of head brownish black with a narrow white line extending between eye and ocellus; fore wings with black-brown markings extending along commissural margin or with light markings meeting black-brown markings on apical half in an oblique line 2
2. Vertex of head with narrow white line extending between ocelli; fore wing with white to yellow markings on basal half extending to or nearly to commissural margin ..... *hubbardi* p. 1117
   Vertex of head with narrow white line not extending between ocelli; fore wing with white to yellow markings only on lateral third of basal two thirds along costal margin ..... *beameri* p. 1118

Henribautia nigricephala (Beamer)

(Pl. LXXIII, fig. 1)

Typhlocyba nigricephala Beamer, Canadian Ent., vol. 75, no. 7, 1943, pp. 131-133.

Henribantia nigricephala, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 97.

Resembling *H. hubbardi,* but differs in having dark brown markings on outer half of fore wing with anterior margin almost trans-

verse, and in lacking narrow white band between ocelli and eyes.

Length.—2.5-3.0 mm.

Color.—Fore wings, with dark brown markings on clavus bordering scutellum roughly bilobed; milky-white to golden-yellow on basal half of wing, dark brown along scutellum; anterior margin of dark brown apical marking almost transverse.

Specimens from Arizona are dark brown to black, while specimens from other localities are lighter brown, nearly maroon.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin forming two evenly rounded lobes, the dorsal lobe bearing a few microsetae and projecting beyond ventral lobe posteriorly, ventral margin slightly lobed.

Internal male genitalia.—Shaft of aedeagus with inferior pair of apical processes directed basad to slightly below middle of shaft, superior pair short, thornlike, slightly curving laterodorsad.

The only known host plant is *Rhamnus californica,* a large series having been collected from it by Dr. R. H. Beamer, July, 1950, at Granite Dells, Arizona. The name of the host plant from which the type series was taken, which differed from the above host, is not known.

Specimens have been seen from the following localities: *Arkansas:* Fouke, December 21; *Mississippi:* Shuqualak, July 16; *Louisiana:* Calcasieu County, August 16; Caddo County, August 19; Colfax, December 23; Vinton, December 25; *Texas:* Orange County, August 14; *Arizona:* Santa Catalina Mountains, July 14; Santa Rita Mountains, July 17, August 18; Yarnell, July 27; Oak Creek Canyon, August 9; Granite Dells, July 5.

The specimens taken in Arizona differ from those from the other states, in being darker in color, and in being one-fifth to one-sixth larger in size in all dimensions, though identical in form and proportions with those from other places. After more is known about the biology of this species, these forms may prove to be distinct species. At present the author considers it best to continue to regard these as extremes in variation of a single species.

Types.—Holotype male, allotype female, and numerous paratypes of both sexes, in the Snow Entomological Collections of the University of Kansas.

Henribautia hubbardi (McAtee)

(Pl. LXXIII, fig. 3)

Erythroneura hubbardi McAtee, Florida Ent., vol. 8, no. 3-4, 1924, p. 35.
Typhlocyba hubbardi, Beamer, Canadian Ent., vol. 66, no. 1, 1934, p. 18.
Henribautia hubbardi, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 97.

Resembling *H. nigricephala,* but differs in having dark brown markings on outer half of fore wing with anterior margin strongly oblique, and in having a narrow white band on vertex of head between ocelli and eyes.

Length.—2.75-3.0 mm.

Color.—A narrow white line between eyes on vertex across ocelli; fore wings with dark brown markings on clavus along scutellum evenly rounded; brown markings continuing along commissural margin on inner half of clavus, joining anterior and posterior markings in some specimens; if not joined, with anterior edge of posterior markings crossing wing obliquely; with a narrow V-shaped white band bordering dark areas and enclosing a triangular golden-yellow area which borders on costal margin near middle; male plate light brown on lateral margins.

Genital capsule.—Male pygofer with posterior lobes not as deeply notched between as in *H. nigricephala.*

Internal male genitalia.—Aedeagus with apical processes parallel to shaft, superior and inferior pairs of almost equal length, fused at base near point of attachment to shaft, superior pair strongly divergent, inferior pair directed basad parallel to shaft.

Specimens have been seen from the following localities in *Arizona:* Chiricahua Mountains, July 8, August 7, September 6; Santa Rita Mountains, June 16, July 16; Huachuca Mountains, June 11, July 9, August 1, October 31.

Types.—Holotype female, in the U. S. National Museum collection; allotype male, in the Snow Entomological Collections of the University of Kansas. Types have been seen by the author.

Henribautia beameri sp. nov.

(Pl. LXXIII, fig. 2)

Resembling *H. nigricephala,* but differs in having more extensive black markings on wing and in having inferior pair of apical processes of aedeagus sharply angled at the middle and directed mesad toward the shaft.

Length.—2.5 mm.

Color.—Vertex of head with narrow yellow line extending between eye and ocellus on each side, yellow color of face sometimes extending anteriorly between ocelli to anterior third of crown; fore wings dark brown over most of their surface, with a bright yellow stripe along basal two thirds of costal margin outlined by a narrow white band.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin medially produced posteriorly as a single lobe.

Internal male genitalia.—Aedeagus with inferior pair of apical processes diverging laterocephalad from shaft for two thirds their length, then directed toward shaft, apices meeting or almost meeting near basal third of shaft, superior pair of processes short, appearing as a distal continuation of base of inferior processes, processes somewhat S-shaped from right lateral aspect.

The host of this species is thought to be *Condalia spathulata.*

Types.—Holotype male, allotype female, and numerous male and female paratypes, Oracle Junction, Arizona, April 29, 1948, R. H. Beamer and L. D. Beamer. One male paratype, Tucson, Arizona, April 28, 1948, R. H. Beamer. Types in the Snow Entomological Collections of the University of Kansas.

Genus Ribautiana Zakhvatkin

(Pls. LXXIV and LXXV)

Ribautiana Zakhvatkin, Rev. Ent. URSS, vol. 28, no. 3-4, (1945), 1947, p. 113.

Type of the genus, *Cicada ulmi* Linnaeus, by original designation.

Fore wings.—Inner and outer apical cells short, not attaining wing apex; second apical cell much broader at apex than at base; third apical cell petiolate, wing apex smoothly rounded; with dark markings at apices of the veins which form distal margins of inner and outer apical cells, dark areas in apices of inner three basal cells. (Pl. LXXIV, fig. 1).

Hind wings.—Vein 1V branching from vein 2V near its mid-length; submarginal vein absent at wing apex; both apical cells open apically; posterior branch of R fused with apical portion of vein M_{1+2}; usually whitish hyaline, fuscous on apical half in *R. ulmi.* (Pl. LXXIV, fig. 1).

Genital capsule.—Male plate, in ventral aspect, abruptly narrowed near middle its length to narrow upturned divergent apex, with single macroseta near outer basal angle and two smaller setae near lateral margin near middle of plate; in lateral aspect, with a number of scattered microsetae, some of which tend to form a submarginal row along lateral margin; pygofer, in lateral aspect, with group of macrosetae just dorsad of outer basal angle of plate, with numerous microsetae in region caudad and dorsad of these, and a small row on inrolled margin directed mesad; posterior margin scarcely inrolled, not differentially sclerotized, not well differenti-

ated, merging with ventral margin; pygofer hooks wanting; anal hooks wanting.

Internal male genitalia.—Style elongate, slender, gradually tapering and curved laterad or dorsad towards apex, inner margin with preapical triangular protuberance and several alveoli, outer margin with a few long setae; connective Y-shaped or triangular; aedeagal articulation terminal or subterminal; aedeagus without preatrial arm; aedeagal apodeme well developed, simple; atrial processes or basal shaft processes present, and usually one or more pairs of processes more distad on the shaft.

Female.—With posterior margin of eighth abdominal sternite as in *R. piscator* (Pl. LXXXVII, figs. 3a, 3b) except in *R. ulmi* (Pl. LXXXVII, figs. 4a, 4b).

Head in dorsal aspect, narrower than pronotum, scarcely produced, median length not greatly exceeding the length next the eye, female longer than male, anterior margin of crown smoothly rounded; in lateral aspect contour of face convex and divergent from the line of dorsum; ocelli absent; pronotum short, with lateral margins greatly divergent posteriorly, and with posterior margin shallowly emarginate; width of pleural portion greatly exceeding width of ocellocular area.

The genus has a Holarctic distribution.

KEY TO THE SPECIES OF RIBAUTIANA

1. Length 3.5-4.0 mm.; fore wings greenish-yellow; abdomen black on venter; aedeagus without processes on shaft. (Pl. LXXIV, fig. 1) ..... *ulmi* p. 1121
   Length 3.25 mm. or less; fore wings white to orange-yellow; abdomen yellow on venter; aedeagus with processes on shaft 2
2. Scutellum dark brown or black 3
   Scutellum light colored 4
3. Aedeagus with two pairs of apical processes, shaft three times as long as atrial processes. (Pl. LXXV, fig. 1) ..... *luculla* p. 1127
   Aedeagus with three pairs of apical processes, median pair branched, shaft twice as long as atrial processes. (Pl. LXXV, fig. 5) ..... *sciotoensis* p. 1128
4. Aedeagus with a pair of processes arising near middle of shaft ... 5
   Aedeagus without processes arising near middle of shaft 6
5. Shaft of aedeagus slender, apex gradually curving ventrocaudad, with two or three pairs of short apical processes. (Pl. LXXIV, fig. 4) ..... *unca* p. 1129
   Shaft of aedeagus stout, apex not curving ventrad, with a pair of apical processes directed cephalad, and a single unpaired process directed dorsad from posterior margin. (Pl. LXXIV, fig. 2) ..... *tenerrima* p. 1122

6. Inferior pair of apical processes of aedeagus with numerous spine-like projections 7
   Inferior pair of apical processes of aedeagus smooth 8
7. Length of shaft of aedeagus beyond apical processes equal or nearly equal to length of inferior processes. (Pl. LXXV, fig. 4) ..... *multispinosa* p. 1125
   Length of shaft beyond apical processes of aedeagus less than half the length of inferior processes. (Pl. LXXV, fig. 3), ... *piscator* p. 1124
8. Apical half of aedeagal shaft nearly straight, inferior pair of processes only slightly curved. (Pl. LXXIV, fig. 3) .. *parapiscator* p. 1123
   Apical half of aedeagal shaft curved into nearly a complete circle, inferior pair of apical processes following curve of shaft. (Pl. LXXV, fig. 2) ..... *foliosa* p. 1126

Ribautiana ulmi (Linnaeus)

(Pl. LXXIV, fig. 1)

Cicada ulmi Linnaeus, Systema naturæ, Regnum animale. ed. 10, 1758, p. 439. (Engelmann reprint, 1894, p. 439.)
Typhlocyba ulmi, Burmeister, Handbuch der Entomologie, 1835, vol. 2, p. 107.
Anomia ulmi, Fieber, Katalogue der europaischen Cicadinen, 1872, p. 15.
Empoa ulmi, Van Duzee, Check List of Hemiptera (excepting the Aphididae, Aleurodidae and Coccidae) of America North of Mexico, 1916, p. 77.
Ribautiana ulmi, Zakhvatkin, Rev. d'Ent. URSS, vol. 28, nos. 3-4, (1945), 1947, p. 113.
Eupteryx ocellata Curtis, British Entomology, vol. 14, art. 640, 1837, p. 2.

Resembling *R. tenerrima*, but easily distinguished by its larger size, darker color, and absence of processes on aedeagal shaft.

Length.—3.5-4.0 mm.

Color.—Head, pronotum, and scutellum pale greenish-yellow, female with two oval black spots on vertex of head between eyes, another on middle of anterior margin of pronotum also present on male, spots faint or absent on teneral specimens; fore wings with basal half evenly colored light yellowish-green to olive-green; abdomen with dorsum and venter black, with a narrow yellow band on posterior margin of each segment, pygofer black.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin produced mesally in an evenly rounded lobe.

Internal male genitalia.—Connective distinctly Y-shaped; aedeagus with pair of broadly flattened atrial processes directed dorsolaterad for half the length of aedeagal shaft; shaft without processes, slender, gradually tapering to slightly bifid apex, recurved on outer fourth; aedeagal apodeme more than one third as long and almost twice as broad as shaft in lateral aspect.

A large series of specimens was taken on *Ulmus fulva* in Milwaukee, Wisconsin, by the author, and a short series is on hand from Salem, Oregon, taken on *Ulmus glabra camperdownii*, by Mr.

John E. Davis. Other specimens seen are labeled only "*Ulmus*", or "Elm".

Specimens have been seen from the following North American localities: *Ontario:* Vineland, July, August, September, October; Jordan, August 11, 15; *Massachusetts:* Cambridge, October 24, 30, November 1; Wood's Hole, July 10, September 1; Arlington, September 10; *Nova Scotia:* King's County, July; *Rhode Island:* Kingston, September; *New York:* Ithaca, October 6; *New Jersey:* Bound Brook; *Ohio:* Columbus, October 13; *Missouri:* St. Louis, April 25; *Wisconsin:* Milwaukee, June 27-July 7; *Texas:* ?; *Utah:* Logan, August 26; *British Columbia:* Vernon; Victoria, August 8, October 12; *Washington:* Seattle; Shelton, July 24; Tacoma, June 29; Puyallup, June; *Oregon:* Salem, September 26; Orenco, November 1; *California:* Mountain View, Milbrae, October 3; Mill Valley, Marin County, October 3; Berkeley, September 1, 8, 12; San Jose, October 24.

Other specimens have been seen from the following European localities: *Germany:* Halle, September 23; *France:* Paris, October 28; *Russia:* Samara, July 15; *England:* Cambridge, October 17; Oxfordshire, June 17; *Scotland:* Edinburgh, August 19; *Finland:* Helsinki, September 25; *Bohemia:* Perimov, September 24; *Sweden:* Uppland, Solna, October 26; Skåne, Ven, August 2; Gotland, Roma K1, July 3.

Ribautiana tenerrima (Herrich-Schäffer)

(Pl. LXXIV, fig. 2)

Typhlocyba tenerrima Herrich-Schäffer, Faunae Insectorum Germanicae initia; oder Deutschlands Insecten gesammelt und herausgegeben von D. G. W. F. Panzer. Fortgesetzt von G. A. W. Herrich-Schäffer, vol. 124, 1834, p. 10.
Typhlocyba rubi Hardy, Trans. Tyneside Nat. Club, vol. 1, 1850, p. 417.
Typhlocyba misella Boheman, Handlingar. Kongliga Svenska Vetenskaps Akademien, 1851, p. 122.
Anomia tenerrima, Fieber, Katalogue der europaischen Cicadinen, 1872, p. 15.
Empoa tenerrima, Van Duzee, Trans. San Diego Soc. Nat. Hist., vol. 2, no. 1, 1914, p. 57.
Ribautiana tenerrima, Zakhvatkin, Revue d'Ent. URSS, vol. 28, no. 3-4. (1945), 1947, p. 113.

Resembles *R. piscator* and other similarly marked species in external appearance, but differs in having aedeagal shaft straight, not curving posteriorly at apex, and in having a pair of short slender basally fused processes arising on posterior margin near middle, another pair on anterior margin, and an unpaired process on posterior margin at apex.

Length.—3.0 mm.

Color.—Head, pronotum, and scutellum pale white to light yellow, without dark markings; fore wings white to yellow; abdomen black

on basal half of dorsum of each segment, venter light yellow, or with narrow black basal band on each segment, basal half of pygofer black.

Genital capsule.—Male pygofer, in lateral aspect, subquadrate, ventral angle projecting slightly beyond dorsal angle.

Internal male genitalia.—Connective triangular; aedeagus with pair of atrial processes elongate, slightly flattened on distal half, length exceeding aedeagal shaft, gradually reduced to acute apices; aedeagal shaft expanded on basal third, laterally compressed shortly before apex, with a pair of short slender basally fused processes arising on posterior margin near middle, another pair at apex directed laterocephalad from anterior margin, and with unpaired dorsally directed process arising from posterior margin at apex; aedeagal apodeme one sixth length of shaft, as broad as narrowest width of shaft in lateral aspect.

The description of this species made by McAtee (1926) was based on a specimen of *R. cruciata* Ribaut, according to Ribaut (1931a, p. 287). The first reliable report of the occurrence of this species in North America was made by H. Andison (1950) from specimens collected on Loganberry at Brentwood, British Columbia, June 20, 1947, and illustrations for this species have been made from one of these. No other North American specimens of this species are known to the author, and previous records of the occurrence of this species apparently apply to other species in the genus.

Determination of this species is based on figures of male genitalia as illustrated by Ribaut (1936, p. 117). A pair of specimens from Sweden, determined by Dr. Ossiannilsson as this species, agree with the North American specimens seen. Other specimens from Europe, determined as *tenerrima* are: a pair of specimens from Budapest, determined by Horvath, which agree with the figures of *Typhlocyba scalaris* Ribaut, (Ribaut, 1936), and a specimen from France, determined by Signoret, which has male genitalia which agree with *T. debilis* Douglas as illustrated in the same paper.

The approved common name for this species is "The Bramble Leafhopper" (Muesbeck, 1950, p. 138).

Ribautiana parapiscator sp. nov.

(Pl. LXXIV, fig. 3)

Typhlocyba piscator McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 7 (part).

Resembling *R. piscator* in external appearance, but with aedeagal shaft forming nearly a right angle near middle and with inferior pair of apical processes smooth.

Length.—2.75 mm.

Color.—Dorsum pale milky white to light orange-yellow; abdomen black on basal half of dorsum of each segment, venter light yellow.

Genital capsule.—Male pygofer, in lateral aspect, subquadrate with dorsal angle projecting beyond ventral angle.

Internal male genitalia.—Aedeagus with atrial process elongate, evenly tapered from base to acute apices, sinuate, almost as long as shaft; aedeagal shaft elongate, slender, bent posteriorly at middle in almost a right angle, with two pairs of slender, smooth, acute processes at apex, superior pair appearing as a continuation of shaft in lateral aspect, slightly curved ventrad, length two thirds that of inferior pair which curve dorsad toward apices of atrial processes.

This species has been collected by the author from *Ostrya virginiana* in abundance, both in Douglas County, Kansas, and in Milwaukee County, Wisconsin, along with *R. multispinosa.*

Types.—Holotype male and twenty-seven male paratypes, Douglas County, Kansas, June 7, 1950, P. J. Christian; additional paratype males: twenty-eight, Douglas County, Kansas, May 30, 1949, R. H. Beamer; two, Douglas County, Kansas, May 30, 1949, P. J. Christian; one, June 1, 1949, Douglas County, Kansas, P. J. Christian; twenty-six, Milwaukee, Wisconsin, June 26-July 5, 1950, P. J. Christian; one, Ames, Iowa, September 20, 1940, D. R. Lindsay; one, Brandenburg, Kentucky, September 14, 1941, D. A. Young; one, Vineland Station, Ontario, September 21, 1940, W. L. Putman; one, Ames, Iowa, September 28, 1894, a paratype of *Ribautiana piscator* bearing the same data as the allotype female of that species.

Holotype and paratypes in the Snow Entomological Collections of the University of Kansas; the Brandenburg, Kentucky, paratype in the U. S. National Museum Collection; the Vineland Station, Ontario, paratype in the Canadian National Collection; and the Ames, Iowa, specimen of the type series of *R. piscator,* in the Iowa State College Collection.

Ribautiana piscator (McAtee)

(Pl. LXXV, fig. 3)

Typhlocyba piscator McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 7 (part).

Ribautiana piscator, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 100.

Resembling *R. multispinosa,* but differing in having length of aedeagal shaft distad of superior pair of processes, shorter than these.

Length.—2.75-3.0 mm.

Color.—Head, pronotum, scutellum and light portions of fore wing pale milky-white to light yellow; abdomen black on basal half of dorsum of each segment, venter yellow.

Genital capsule.—Male pygofer, in lateral aspect, somewhat quadrate, dorsal angle rounded, projecting beyond ventral angle which is less distinct.

Internal male genitalia.—Aedeagus, with pair of atrial processes three fourths as long as shaft, elongate, gradually reduced to acute apices, sinuate; shaft broadly curved posteriorly, with two pairs of apical processes of about equal length, superior pair slender, smooth, directed ventrolaterad toward apices of atrial processes, inferior pair fused basally, a stout spine on mesal margin at basal third, numerous small spines scattered over apical two thirds.

Most of the specimens seen have the inferior pair of processes more spinose than in the specimen figured which is nearer in appearance to the holotype than any of the other specimens seen.

A series of twenty specimens, eleven males and nine females, were collected by the author from *Carpinus caroliniana* in Milwaukee, Wisconsin, July 7, 1950.

Type.—Holotype male, Elizabeth, Illinois, in the Illinois State Natural History Survey Collection; allotype female, in the Iowa State College Collection, bears the same data as a paratype male which is a specimen of *Ribautiana parapiscator,* and is probably also a specimen of that species.

Ribautiana multispinosa sp. nov.

(Pl. LXXV, fig. 4)

Resembling *R. piscator,* but differing in having length of aedeagal shaft distad of superior pair of processes longer than these.

Length.—2.75-3.0 mm.

Color.—Head, pronotum, scutellum and light areas of fore wings pale milky-white to light yellow; abdomen black on basal half of dorsum of each segment, venter yellow.

Genital capsule.—Male pygofer, in lateral aspect, somewhat quadrate, dorsal angle rounded, projecting beyond ventral angle.

Internal male genitalia.—Aedeagus with pair of atrial processes elongate, evenly tapered from base to acute apices, sinuate, almost half as long as aedeagal shaft; shaft elongate, slender, bent posteriorly on outer third, forming a half circle in lateral aspect, apex curving toward middle of shaft; two pairs of processes on apical sixth of shaft, superior pair slender, smooth, directed laterocaudad

toward apices of atrial processes, half as long as inferior pair which are broadly flattened laterally forming an oval in caudal aspect and armed with numerous short stout spines which vary somewhat in number and location on different specimens.

This species has been collected by the author from *Ostrya virginiana* in association with *R. parapiscator,* in Milwaukee, Wisconsin, and in Douglas County, Kansas.

Types.—Holotype male, July 2, 1950, Milwaukee, Wisconsin, P. J. Christian; paratype males: eight, May 30, one, June 5, 1949, Douglas County, Kansas, R. H. Beamer; one, June 1, 1949, eight, June 7, 1950, Douglas County, Kansas, P. J. Christian; one, June 28, three, July 1, two, July 2, one, July 3, three, July 5, 1950, Milwaukee, Wisconsin, P. J. Christian; one, July 4, 1949, Cheboygan County, Michigan, H. B. Hungerford. An abnormal male of this species, August 1, 1949, Cheboygan County, Michigan, H. B. Hungerford, is not made a paratype. Types in the Snow Entomological Collections of the University of Kansas.

Ribautiana foliosa (Knull)

(Pl. LXXV, fig. 2)

Typhlocyba foliosa Knull, Ohio J. Sci., vol. 45, no. 3, 1945, pp. 104, 107, pls. 1-2.
Ribautiana foliosa, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 100.

Resembling *R. piscator,* but differing in having apical half of aedeagal shaft forming nearly a circle, and in having the inferior pair of shaft processes smooth and strongly curved, following the curvature of the shaft.

Length.—3.0 mm.

Color.—Head, pronotum, and scutellum pale milky-white to light orange yellow; abdomen black on basal half of dorsum of each segment.

Genital capsule.—Male pygofer, in lateral aspect, somewhat quadrate, dorsal angle rounded, projecting beyond ventral angle.

Internal male genitalia.—Aedeagus with atrial processes broadly attached at base, distinctly S-shaped in left lateral aspect, gradually reduced to sharp apices, half as long as aedeagal shaft, sinuate in posterior aspect; aedeagal shaft swollen at base and broadly flattened on outer third, with two pairs of processes near apex, inferior pair foliaceous, curved ventrolaterad in a semicircle, with apices directed toward apices of atrial processes, superior pair of processes forming almost a complete circle with the distal half of shaft, apices directed ventrolaterad toward middle of shaft in lateral aspect, shaft sharply reduced to a short sinuate apex beyond processes.

A number of specimens of this species have been taken by the author from *Fagus grandifolia.* Two other specimens are on hand labeled "host *Carpinus caroliniana*", while another specimen from the same locality is labeled "*Fagus grandifolia*". One male specimen from New Hampshire, determined by McAtee as *R. piscator,* and a male paratype have been seen. Specimens seen have been from the following localities: *Ontario:* Vineland Station, September 19; *Manitoba:* Birtle, August 6, 10, September 2; *New Hampshire:* Durham, June 23; *Virginia:* Mountain Lake, July 2; *Tennessee:* Gatlinburg, June 24, 25; *Ohio:* Hocking County, September 16; Delaware County, October 10; *Wisconsin:* Milwaukee, July 5; *Minnesota:* Itaska County, July 26-28.

Types.—Holotype, allotype, and paratypes in the collection of Mrs. J. N. Knull; six paratypes in Ohio State University Collection.

Ribautiana luculla (Medler)

(Pl. LXXV, fig. 1)

Typhlocyba luculla Medler, Minnesota Agr. Exp. Sta. Tech. Bull., no. 155, 1942, pp. 139-140, pl. 9.
Ribautiana luculla, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 100.

Resembling *R. sciotoensis* in outward appearance, but with aedeagal shaft dorsoventrally flattened, with only two pairs of apical processes on shaft.

Length.—3.25 mm.

Color.—Head, pronotum, and light portions of fore wing pale yellowish white; scutellum fuscus; fore wing with band across distal ends of three inner basal cells more pronounced, cross veins darker near wing margins, third apical cell fuscus; abdomen black on dorsum, yellow on venter.

Genital capsule.—Male pygofer, in lateral aspect, somewhat quadrate, dorsal angle rounded, projecting beyond ventral angle.

Internal male genitalia.—Aedeagus, with pair of atrial processes one half width and one third length of shaft in lateral aspect, very gradually reduced to acute apices, sinuate; aedeagal shaft slender, greatly attenuated, width in lateral aspect one third width from caudal aspect, inferior pair of processes at outer third of shaft with apices directed toward apices of atrial processes, slightly broader but only half as long as atrial processes, superior pair of processes as long and stout as inferior pair, directed dorsolaterad, arising at half their length from apex of shaft.

The host plant for this species is believed to be *Corylus americana,* on the basis of a female specimen taken on that host, which

agrees in external appearance with a male paratype of this species.

The following specimens have been seen: one female, La Crosse, Wisconsin, August 7; one female, Merrillan, Wisconsin, August 5; one female, Thornton, Illinois, September 7; and a series of twelve unpinned male and female specimens from Illinois, in the Illinois Natural History Survey Collection.

Types.—Holotype male and two paratype males, in the University of Minnesota Collection; one male paratype in the Snow Entomological Collections of the University of Kansas.

Ribautiana sciotoensis (Knull)

(Pl. LXXV, fig. 5)

Typhlocyba sciotoensis Knull, Ohio J. Sci., vol. 45, no. 3, 1945, pp. 103, 107, pl. 2.
Ribautiana sciotoensis, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 100.

Resembling *R. luculla* in external appearance, but with third apical cell white, and with three pair of apical processes on aedeagal shaft, the median pair branching.

Length.—3.0 mm.

Color.—Head and pronotum chalky white with a yellowish tinge; scutellum dark brown, darker in median basal area; fore wing with a pronounced dark brown band over white crossveins, extending farther anteriorly than posteriorly.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin distinct, ventral angle projecting beyond dorsal angle.

Internal male genitalia.—Aedeagus, with pair of atrial processes narrow, reaching to two thirds length of shaft, separated at base by three times width of shaft, directed dorsocaudad parallel to each other, apex of shaft slightly broadened and strongly curved ventrad, bearing three pairs of apical processes the superior pair arising before apex, incurving, median pair branched, directed laterad, inferior pair curved sharply ventrad, apices directed toward apex of shaft in lateral aspect; aedeagal shaft sharply curved, narrowing from broad base to complex apex, forming an incomplete semicircle, somewhat swollen at juncture of processes. Illustrations for this species are adapted from the original description by permission of the author.

The following specimens have been seen: one paratype, Scioto County, Ohio, June 17, and one female from Salamanca, New York, July 24.

Types.—Holotype, allotype, and male paratype in the collection of Mrs. J. N. Knull.

Ribautiana unca (McAtee)

(Pl. LXXIV, fig. 4)

Typhlocyba unca McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 8.
Ribautiana unca, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 100.
Typhlocyba surda DeLong and Johnson, Ent. News, vol. 47, no. 4, April, 1936, pp. 101-102. (new synonymy).
Ribautiana surda, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 100.

Resembling *R. piscator* in external appearance, but with a pair of processes arising from near middle of aedeagal shaft, apical processes short and without numerous spines.

Length.—3.0 mm.

Color.—Head, pronotum, and scutellum pale milky-white to light orange yellow.

Genital capsule.—Male pygofer, in lateral aspect, somewhat quadrate, dorsal angle rounded, projecting beyond ventral angle.

Internal male genitalia.—Aedeagus, with atrial processes elongate, nearly as long as shaft, evenly tapered from base to acute apices, sinuate; shaft elongate, slender on apical half, with a pair of dorsolaterally directed processes arising at or slightly below middle, apex curved toward apices of atrial processes, bearing at apex from one to three pairs of short processes which show a marked degree of variability. (Pl. LXXIV, figs. 4d, e, f, g.)

R. surda (DeLong and Johnson) is based upon a specimen of this species with the apical processes broadened toward the base, and is considered synonymous with *R. unca* (McAtee).

A series of specimens from Glen Haven, Colorado, differ from other specimens seen in having the median pair of processes arising from the base at a point lower than the aedeagal apodeme.

Numerous specimens of this species have been collected by Dr. R. H. Beamer and the author from *Corylus americana*. Other specimens have been seen with the following host labels: "vine maple," "on filbert," "alder," and "on beech."

Specimens have been seen from the following localities: *Maine:* Fryeburg, August 20; *Massachusetts:* Holliston, September 4; *New Hampshire:* Durham, September 9; *New York:* Cranberry Lake, July 25; Salem, June 27, July 27; Minetto, July 23, September 16; *Pennsylvania:* Hartstown Bog, September 12, 13, 14; Snowshoe, August 22; Northeast, July 4; *Ontario:* Ottawa, June 24, Trenton, September 30; *Tennessee:* Gatlinburg, June 29; Great Smoky Mountain National Park, September 1; *Virginia:* Glencarlyn, June 12; *Michigan:* September 23, Gogebic, August 18; *Wisconsin:* Mil-

waukee, June 26-July 5; Lake Geneva, June 21; *Minnesota:* Itaska County, July 16, 26, 27; Anoka County, September 21; *Illinois:* Salem, September 22; *Manitoba:* Deepdale, August 1; *Missouri:* Goodman, May 28; *Kansas:* Douglas County, May 27, 30, June 1, 7; Jefferson County, June 15; *Colorado:* Glen Haven, August 3; *Oregon:* Woodburn, October 2; Selma, June 14; *California:* Marin County, August 3; Giant Forest, July 28; Fort Dick, July 13; Leona Hights, Alameda County, August; Wild-Cat Canyon, San Pablo, Contra Costa County, May 16.

Types.—Holotype male, and paratype males and females, in the U. S. National Museum Collection; allotype female and paratypes of both sexes in the Iowa State College Collection.

Mcateeana gen. nov.

(Pl. LXXIII, fig. 4)

Type of the genus, *Empoa querci* var. *sexnotata* Van Duzee.

Fore wings.—Inner and outer apical cells short, not attaining wing apex; second apical cell much broader at apex than at base; third apical cell petiolate; wing apex smoothly rounded. (Pl. LXXIII, fig. 4h).

Hind wings.—Vein 1V branching from vein 2V near its midlength; submarginal vein absent at wing apex; both apical cells open apically; posterior branch of R fused with apical portion of vein M_{1+2}. (Pl. LXXIII, fig. 4h).

Genital capsule.—Male pygofer, in lateral aspect, with a small group of short macrosetae dorsad of outer basal angle of male plate and a few microsetae caudad of these, with posterior margin slightly inrolled and bearing a few microsetae near posterior angle on mesal surface, with awl-shaped spines scattered on posterior third, pygofer hooks wanting; male plate in ventral aspect, broadened at base, widest at basal fourth, gradually reduced to upturned apex, in lateral aspect with single macroseta near outer basal angle, a row of microsetae on dorsolateral margin of apical two thirds, others along ventrolateral margin on apical half.

Internal male genitalia.—Style elongate, slender, gradually tapering and curved laterad or dorsad, abruptly curved ventrad before apex, inner margin with several alveoli on outer margin, with a few setae near middle, and a single large seta basad of apical curve; connective Y-shaped; aedeagal articulation subterminal; aedeagus with preatrial arm well developed, aedeagal apodeme well developed, shaft not present, gonopore at base of fused portion of apically branching atrial processes.

Female.—With posterior margin of eighth abdominal sternite as shown in Pl. LXXXVII, figs. 5a, b.

The head in dorsal aspect narrower than pronotum, moderately produced, its median length not greatly exceeding length next the eye, anterior margin of crown smoothly rounded; face convex, divergent from the line of the dorsum; ocelli present; pronotum short, with lateral margins greatly diverging caudally, posterior margin shallowly emarginate.

The following species is the only representative of this genus known.

Mcateeana sexnotata (Van Duzee) (*new combination*)

(Pl. LXXIII, fig. 4)

Empoa querci var. *sexnotata* Van Duzee, Trans. San Diego Soc. Nat. Hist., vol. 2, no. 1, 1914, p. 57.
Typhlocyba querci var. *sexnotata*, McAtee, Canadian Ent., vol. 51, no. 8, 1919, pp. 225-226.
Typhlocyba sexnotata, McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 34.
Ossiannilssonia sexnotata, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Length.—3.5 mm.

Color.—Head and pronotum yellowish-white; scutellum orange-red, disc yellow; fore wings whitish hyaline, with inner half of clavus and most of brachial cell light orange-yellow, with a large brown spot in apex of brachial cell and two round black spots on clavus, one at middle, the other near apex of scutellum, with commissural vein black near apex of scutellum in some specimens, distal ends of second and third basal cells, and apical cells fumose; abdomen with dorsum black, apical margin of each segment yellow, venter yellow, male plates yellow.

Internal male genitalia.—Aedeagus with a pair of stout, forcipate, basally fused atrial processes bearing two pairs of slender, posteriorly directed, apical branches, the superior pair directed dorsocaudad, each pair crossing apically; aedeagal apodeme directed cephalad for three fourths length of preatrial arm.

Specimens labeled "sycamore", and others labeled "*Ribes*" are on hand. All specimens seen by the author are from California.

Types.—Holotype female, in California Academy of Sciences Collection; *neoallotype* male, Gilroy, California, August, 1942, R. H. Smith, here designated, and one male *paraallotype,* San Luis Obispo, August, 1942, R. H. Smith, in the Snow Entomological Cellections of the University of Kansas. Additional *paraallotype* males: one, Cucamonga, California, December 21, 1917, in the Cornell Uni-

versity Collection; one, Niles Canyon, California, July 15, 1916, E. P. Van Duzee, in the California Academy of Sciences Collection.

GENUS OSSIANNILSSONOLA nov. nom.

(Pls. LXXVI-LXXX)

Ossiannilssonia Young and Christian, *in* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, pp. 97-99.

Type of the genus, *Typhlocyba berenice* McAtee, by original designation.

Fore wings.—Inner and outer apical cells short, not attaining wing apex; second apical cell much broader at apex than at base; third apical cell petiolate; wing apex smoothly rounded.

Hind wings.—Vein 1V branching from vein 2V near its mid-length; submarginal vein absent at wing apex; both apical cells open apically; posterior branch of R fused with apical portion of vein M_{1+2}.

Genital capsule.—Male plate, in ventral aspect, gradually narrowed on outer margin towards apex, occasionally with small lobe on lateral margin before apex (*O. appendiculata* and *O. phryne*), without single macroseta near outer basal angle of male plate, with a dorsal submarginal row of setae and a row of microsetae along ventrolateral margin on apical half; pygofer, in lateral aspect, with posterior margin distinct, not rounded to ventrocaudal margin, rectilinear in form; pygofer wall frequently with sclerotized bars occurring within the limits of pygofer proper, or prolonged dorsocaudad or caudad as short pygofer hooks; a group of macrosetae usually present on pygofer just dorsad of outer basal angle of male plate, with numerous small awl-shaped cuticular projections over dorsal posterior half of pygofer, and a row of microsetae on disc extending dorsocaudad from the group of macrosetae; anal hooks wanting.

Internal male genitalia.—Style elongate, slender, gradually curved laterad or dorsolaterad apically, usually without triangular preapical projection on inner margin (exceptions, *O. danae*, *O. bangsoni*, and *O. flavomarginata*), with elongate slender setae on outer margin, with a few alveoli on inner margin; connective triangular or Y-shaped; aedeagus with preatrial arm distinct, aedeagal apodeme short, well developed or not, shaft occurring as a flattened membranous structure between basal portions of a pair of forcipate atrial processes.

Female.—With posterior margin of eighth abdominal sternite usually broadly evenly rounded as in *O. berenice* (Pl. LXXXVII, figs. 6a, b), except in *O. flavomarginata* where it is strongly incised

laterally forming two lateral lobes and a slightly emarginate median lobe (Pl. LXXXVII, figs. 7a, b).

Head, including the eyes, narrower than pronotum, only slightly produced medially on rounded anterior margin, median length of the crown not greatly exceeding length next the eyes, face strongly convex to slightly below antennal insertions, then slightly convex to tip of clypellus; ocelli present or absent, when present, situated on round margin between crown and face, nearer the eyes than to each other; pronotum short, but much longer than head, lateral margins greatly divergent caudally, posterior margin shallowly concave; width of pleural portion greatly exceeds width of ocellocular area.

The species are usually pale in color, with dark markings which are occasionally extensive.

Most of the species of this genus live on species of *Quercus*, but *Ulmus*, *Crataegus*, *Acer*, and *Prunus* are also host genera. None of the known North American species has been recorded from outside of this continent, but from the figures of *Typhlocyba callosa* Then, by Ribaut (1936), it appears that this species could belong to this genus, and should this be true, the range of this genus would be holarctic.

Key to the Species of Ossiannilssonola

1. Male plate distinctly forked near apex 2
   Male plate not forked 3
2. With black parenthesis-shaped marks on pronotum; fore wing with narrow black lines along commissural margin to crossveins; pygofer with posterior angle strongly produced in a broad rounded lobe. (Pl. LXXIX, fig. 2a) ..... *phryne* p. 1152
   With light colored pronotum, pygofer with posterior margin nearly vertical, only slightly produced on dorsal angle. (Pl. LXXIX, fig. 1a) ..... *appendiculata* p. 1150
3. Styles with apical third sharply curved mesad, a small triangular protuberance on lateral margin. (Pl. LXXX, fig. 2e), *flavomarginata* p. 1157
   Styles with apical third not curved mesad 4
4. Styles appearing truncate at apex, with small projection near apex, 5
   Styles evenly tapering to an acute apex 6
5. Triangular projection on lateral margin of style near apex; pygofer with two vertically arranged, posteriorly directed hooks on dorsal posterior margin. (Pl. LXXVIII, fig. 1) ..... *bangsoni* p. 1145
   Triangular projection on mesal margin of style near apex; pygofer with two horizontally arranged, mesally directed hooks on dorsal posterior margin. (Pl. LXXVIII, fig. 5) ..... *danae* p. 1149
6. Atrial processes forked near apex 7
   Atrial processes not forked 8

7. Pygofer with posterior margin nearly vertical, dorsal angle forming a broad, blunt, dorsomesally directed process. (Pl. LXXVI, fig. 1) ..... *berenice* p. 1136
   Pygofer with posterior margin obliquely slanted toward base of plate, dorsal angle forming a moderately rounded projection with two mesally directed, spinelike processes. (Pl. LXXVI, fig. 2) ..... *hermione* p. 1137
8. Atrial processes tumid, apical third sharply reduced, slender, thornlike 9
   Atrial processes not tumid, gradually tapering to apex 11
9. Atrial processes greatly broadened at base in posterior aspect, lateral margins nearly parallel; fore wing with entire basal half bright crimson red, without black markings. (Pl. LXXVII, fig. 3) ..... *tunicarubra* p. 1141
   Atrial processes not greatly broadened at base in posterior aspect, lateral margins divergent toward apex; fore wings white to yellow with black spots in apices of inner three basal cells 10
10. Posterior margin of tumid portion of atrial processes forming nearly a right angle near middle, in lateral aspect. (Pl. LXXVII, fig. 4) ..... *australis* p. 1142
    Posterior margin of tumid portion of atrial processes forming an evenly rounded semicircle, in lateral aspect. (Pl. LXXVII, fig. 2) ..... *clymene* p. 1140
11. Ventral angle of pygofer directed caudally as a small thumblike lobe. (Pl. LXXVI, fig. 3) ..... *volans* p. 1138
    Ventral angle of pygofer without lobe, or with lobe directed ventrad when present 12
12. Atrial processes gradually curved dorsocaudad 13
    Atrial processes abruptly bent caudad 14
13. Dorsal angle of pygofer projecting caudad beyond ventral angle as a broad quadrate process bearing two mesally directed diverging spines. (Pl. LXXVIII, fig. 2) ..... *duplicata* p. 1146
    Dorsal angle of pygofer not projecting caudad as a quadrate process, but as two short fingerlike processes which cross each other. (Pl. LXXVII, fig. 1) ..... *antigone* p. 1139
14. Dorsal angle of pygofer forming a broad caudally directed hook, lower half of the posterior margin S-shaped from the left side, ventral angle broadly rounded 15
    Dorsal angle of pygofer not forming a hook, posterior margin straight, ventral angle somewhat angulate 17
15. Pygofer hook large, half as deep as broad; atrial processes of aedeagus broadly flattened beyond membrane, appearing forked in posterior aspect. (Pl. LXXIX, fig. 3) ..... *rossi* p. 1153
    Pygofer hook small, one third to one fourth as deep as broad; atrial processes not appearing forked in posterior aspect 16
16. Base of aedeagus greatly broadened laterally, abruptly reduced before bases of atrial processes to one third its greatest width; with sclerotized plate extending over bases of atrial processes; pygofer with two acute mesocaudally directed spines on dorsal posterior margin. (Pl. LXXX, fig. 3) ..... *quadrata* p. 1155

Base of aedeagus of almost uniform width; bases of atrial processes not covered by a sclerotized plate; pygofer with only slight projections on dorsal posterior margin. (Pl. LXXIX, fig. 4) ..... *knulli* p. 1154

17. Atrial processes widely separated at base, apices finely serrate. (Pl. LXXVIII, fig. 3) ..... *serrula* p. 1147

Atrial processes not widely separated at base, apices smooth 18

18. Dorsal angle of pygofer excavated; fore wings milky-white, with two dark crossbands, anterior band interrupted by white scutellum. (Pl. LXXVII, fig. 5) ..... *hinei* p. 1144

Dorsal angle of pygofer not excavated; fore wings with black spots only in apices of inner three basal cells 19

19. Dorsal angle of pygofer directed dorsad as a broad acutely-angled hook, ventral angle produced as a short caudally directed hook. (Pl. LXXX, fig. 1) ..... *troza* p. 1156

Dorsal angle of pygofer not directed dorsad as a broad acutely angled hook, but mesocaudad as a short broad lobe; ventral angle rounded, not projecting caudad. (Pl. LXXVIII, fig. 4), *mcateei* p. 1148

Many of the species of this genus can be distinguished on the basis of color markings. The following key based on fully colored specimens will permit the determination of female specimens of a number of species, but closely colored species which are not easily distinguished have of necessity been grouped together.

COLOR KEY TO THE SPECIES OF OSSIANNILSSONOLA

1. Without black or brown markings on fore wings 2
   With black or brown markings, or traces of these on fore wing ... 6
2. Fore wings with crimson, or light red markings 3
   Fore wings white or orange-yellow 4
3. Anterior half of fore wings bright crimson-red, white on remainder of dorsum ..... *tunicarubra* p. 1141
   Entire fore wing colored light red; head, pronotum, and scutellum bright yellow ..... *flavomarginata* type III p. 1157
4. Dorsum white to cream colored ..... *flavomarginata* type V p. 1158
   Dorsum orange-yellow 5
5. Length 3.25 mm. ..... *flavomarginata* type IV p. 1158
   Length 3.5-3.75 mm. ..... *serrula* p. 1147
6. Dark markings extensive, not restricted to three spots anterior to cross veins 7
   Dark markings not extensive, restricted to three spots, one in each of inner three basal cells just anterior to cross veins 13
7. Dark markings in the form of two transverse bands 8
   Dark markings not as two transverse bands 10
8. Anterior band near base of fore wings, interrupted by white scutellum ..... *hinei* p. 1144
   Anterior band near middle of fore wing 9

9. Posterior band solid color ..... *volans* p. 1138
   Posterior band made up of six distinctly separated spots, ground color of dorsum milky-white, resembling forms of *Empoa*, casta group ..... *duplicata* p. 1146
10. Dark markings covering entire dorsum ..... *flavomarginata* type II p. 1157
    Dark markings less extensive 11
11. Dark markings forming a brown saddle over fore wings anterior to cross veins, sometimes limited in extent to only the apical third of inner three basal cells and a stripe along claval suture, *appendiculata* (in part) p. 1150
    Dark markings otherwise 12
12. With dark parenthesis-shaped markings on pronotum which continue posteriorly to cross veins as a black commissural line, *phryne* p. 1152
    With dark markings in apical cells along cross veins and apical veins ..... *berenice* (in part) p. 1136
13. Ground color orange-yellow, *antigone*, *berenice* (in part), *quadrata*, *rossi*, and *knulli*
    Ground color white to light yellow 14
14. With a flavescent stripe along commissural suture 15
    Without such a stripe 16
15. With row of black spots slanting obliquely toward apex of wing, *flavomarginata* type I p. 1157
    With row of black spots nearly transverse ..... *australis* (in part) p. 1142
16. Ground color cream, dark brown spots filling most of outer fourth or fifth of inner three basal cells, irregular in intensity, *appendiculata* (in part) p. 1150
    Ground color white, dark spots smaller, of even intensity, *danae*, *clymene*, *hermione*, *troza*, *mcateei*, *bangsoni*, *australis* (in part)

Ossiannilssonola berenice (McAtee) (*new combination*)

(Pl. LXXVI, fig. 1)

Typhlocyba berenice McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 38.
Ossiannilssonia berenice, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *O. hermione* in shape of the aedeagus, but differing in lacking spinelike hooks on mesal margin of dorsal angle of pygofer, and in having posterior margin of pygofer vertical.

Length.—3.25-3.5 mm.

Color.—Head, pronotum, and scutellum yellow to orange-yellow; fore wings light yellow to uniform deep orange-yellow anterior to cross veins, lighter apically, veins sometimes red-orange, wing subhyaline to cross veins, hyaline apically, with a transverse row of three black spots in apices of inner three basal cells separated from veins by a narrow yellow margin; apical cells smoky along veins and outer margins, forming indistinct spots in apical cells three and

four; abdomen with dorsal segments black medially, yellow to orange-yellow laterally, venter yellow, male plate yellow. Black spots sometimes reduced or missing.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin vertical, dorsal angle forming a broad blunt dorsally directed projection, ventral angle nearly a right angle, a few macrosetae on posterior margin near dorsal angle.

Internal male genitalia.—Aedeagus, with atrial processes elongate, slender, apices almost meeting medially, in posterior aspect outlining a rectangle, a single pair of slender subapical processes arising from the posterior margin and curving mesocaudad, crossing at outer fourth; aedeagal apodeme one fourth length of atrial processes, directed cephalad on apical third in lateral aspect.

Several thousand specimens of this species have been collected by the author from *Quercus alba* in Milwaukee, Wisconsin, in association with *O. australis* and *O. danae.*

Specimens have been seen from the following localities: *Ontario:* Toronto, August 8; *Massachusetts:* Wood's Hole, July 10; *Connecticut:* New Haven, July 4; *New York:* Ithaca, July 8; *District of Columbia:* Rock Creek, June 19; *Virginia:* Arlington, October 12; Mountain Lake, July 17; *North Carolina:* Franklin, August 17; *Illinois:* Thornton, September 7; *Wisconsin:* Milwaukee, June 26-July 7; *Minnesota:* Ramsay County, August 30; St. Paul, June 27.

Types.—Holotype male and one male paratype in the U. S. National Museum Collection, Washington, D. C.; a female specimen from Milwaukee, Wisconsin, June 30, 1950, taken in copula with a male of this species, here designated *neoallotype,* in the Snow Entomological Collections of the University of Kansas.

Ossiannilssonola hermione (McAtee) (*new combination*)

(Pl. LXXVI, fig. 2)

Typhlocyba hermione McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 38-39.
Ossiannilssonia hermione, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *O. berenice* in shape of aedeagus, but differing in having two spinelike hooks on mesal margin of dorsal angle of pygofer, and in having ventrocaudal margin oblique.

Length.—4.0 mm.

Color.—Head, pronotum, and scutellum white to yellowish-white; fore wings whitish-hyaline with three black spots anterior to cross veins, apical cells slightly fumose; abdomen white, male plates white.

Genital capsule.—Male pygofer, in lateral aspect, with ventrocaudal margin obliquely slanted from base of plate to dorsal angle, ventral angle directed ventrad in a lobe, dorsal angle appearing as a moderately rounded projection with two vertically arranged toothlike processes directed mesad from inner margin, upper process one third length of lower.

Internal male genitalia.—Aedeagus with atrial processes elongate, slender, gradually reduced toward apex, curving ventromesad and continuing anteriorly, a pair of short subapical processes arising from dorsal surface; aedeagal apodeme a short apically enlarged shaft directed cephalodorsad.

The following specimens have been seen by the author: holotype male, Washington, D. C., July 2; paratype male, Madison, Wisconsin, August 11; paratype male, Bluemont, Virginia, July 1; one male, Northeast, Pennsylvania, July 7.

Types.—Holotype male and paratype males, in the U. S. National Museum Collection.

Ossiannilssonola volans (McAtee) (*new combination*)

(Plate LXXVI, fig. 3)

Typhlocyba querci var. *volans* McAtee, Canadian Ent., vol. 51, no. 8, 1919, pp. 225-226.
Typhlocyba gillettei var. *volans*, McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 28.

Resembling *O. hinei* in color markings, but differing in having anterior band at middle of fore wing; ventrocaudally directed thumblike lobe on pygofer distinguishing it from other species in the genus.

Length.—3.75-4.0 mm.

Color.—Head, pronotum, and scutellum light yellow; fore wing light yellow overlaid with variable dark brown markings which usually form two broad bands, one over the cross veins forming a broad inverted V, the other V-shaped, arising at the middle of clavus and slanting obliquely forward to costal margin; some specimens from the Great Smoky Mountains taken on *Prunus pennsylvanicus* differ from this pattern by having a longitudinal band connecting these transverse bands, others by having only traces of this band; specimens collected from *Ulmus fulva* differ by having the anterior band transverse and posterior band nearly transverse; apical cells fumose; abdomen with black markings on dorsum, venter yellow, plates yellow.

Genital capsule.—Male pygofer, in lateral aspect, with dorsal angle a broad rounded lobe projecting caudally beyond ventral

angle, without hooks, ventral angle produced caudally into a thumb-like lobe, a number of macrosetae scattered submarginally along dorsal two thirds of posterior margin.

Internal male genitalia.—Aedeagus, with atrial processes elongate, slender, unbranched, in caudal aspect describing an oval, apices sharply directed ventromesad and crossing near tip, aedeagal apodeme reduced to a short anteriorly directed arm.

Several hundred specimens have been collected by the author in Milwaukee, Wisconsin, and in Lawrence, Kansas, from *Ulmus fulva.* Additional specimens seen are from the following localities: *Ontario:* Vineland Station, August 2; *New York:* Monroe, July 10; Batavia, July 15; Indian Lake, Sabael, August 25; *Pennsylvania:* Hartstown Bog, June 26; *Tennessee:* Great Smoky Mountain National Park, July 30, September 1; *Michigan:* Agricultural College, July 7; *Wisconsin:* Marshfield, August 20; *Milwaukee,* June 26-July 7; *Utah:* Richfield, July 15; *Kansas:* Douglas County, June 9, August; *Oregon:* Portland, August 1; Independence, June 21; Azalea, September; McMinville, August 15; *California:* Placer County, June 16.

One pair of paratype specimens of *Typhlocyba gillettei* var. *casta* McAtee, bearing the label "Douglas Co. Ks. August 1923 W. Robinson" are specimens of this species like those collected on *Ulmus fulva.*

Types.—Mr. M. E. Neary, Entomologist for the Nova Scotia Department of Agriculture and Marketing, informs me that the holotype female of this species was destroyed by fire in June, 1946.

Because of the lack of material from the type locality, and the diversity of color pattern found in the specimens on hand, the author considers it best not to erect a neotype for this species until specimens from the type locality are available.

Ossiannilssonola antigone (McAtee) (*new combination*)

(Pl. LXXVII, fig. 1)

Typhlocyba antigone McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 35-36.
Ossiannilssonia antigone, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.
Typhlocyba eurydice var. *distincta* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 38. (*new synonymy*)

Resembling *O. berenice* externally, but distinguished by having two fingerlike processes at dorsal angle of pygofer, and in not having atrial processes of aedeagus branching near apex.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum pale yellow to orange-

yellow; fore wing pale yellow to orange-yellow, subhyaline to cross veins, apex hyaline with indistinct black spots in apices of inner three basal cells, veins in some specimens orange-red, in others almost white; abdomen yellow, plates yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin sinuate, dorsal angle produced in two short fingerlike processes directed mesocaudad and crossing each other, ventral angle forming an angular lobe projecting caudally as much as dorsal processes, without macrosetae dorsad of outer basal angle of plate, with two or three macrosetae on dorsal posterior margin.

Internal male genitalia.—Aedeagus with atrial processes short, stout, half as long as base in lateral aspect, with apices directed toward each other and slightly caudad, describing almost a complete circle in caudal aspect; aedeagal apodeme short, as broad as long in lateral aspect.

Only a few specimens of this species have been seen. The author has taken a single pair from *Quercus alba* in Jefferson County, Kansas, in association with *O. tunicarubra*, and a single male from the same host in Milwaukee, Wisconsin. Other specimens seen are from the following localities: *Connecticut:* New Haven, July 4; *Maryland:* Beltsville, June 23; *Delaware:* Wilmington, June 20; *Virginia:* Glencarlyn, June 12, 16, 20; Arlington, June 14; Mountain Lake, July 23; *Illinois:* Monticello, June 11; *Wisconsin:* Milwaukee, July 3; *Kansas:* Jefferson County, June 15.

The holotype and six paratype males have been seen.

Types.—Holotype male, in the Illinois State Natural History Survey Collection; paratypes in the U. S. National Museum, and DeLong Collections; a female specimen collected by the author in Jefferson County, Kansas, June 15, 1950, here designated *neoallotype*, in the Snow Entomological Collections of the University of Kansas.

The holotype specimen of *Typhlocyba eurydice* var. *discincta* McAtee, from Beltsville, Maryland, has been dissected and found to be a specimen of *O. antigone*.

Ossiannilssonola clymene (McAtee) (*new combination*)

(Pl. LXXVII, fig. 2)

Typhlocyba clymene McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 36-37.
Ossiannilssonia clymene, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *O. australis* in external appearance and in the shape of the aedeagus, but differing in having the ventral angle of the

pygofer rounded apically and slightly projecting caudad, and in having ventral margin of atrial processes of aedeagus rounded, not angular.

Length.—3.5-3.75 mm.

Color.—Head, pronotum, and scutellum white to light yellow; fore wings pale yellowish-white with a transverse row of three black spots in apices of inner three basal cells, apical cells hyaline; abdomen white, male plates white.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly vertical, dorsal and ventral margins nearly parallel, dorsal and ventral angle evenly rounded, not produced, a row of macrosetae along dorsal half of posterior margin.

Internal male genitalia.—Aedeagus with atrial processes short, greatly enlarged to outer third, sharply reduced on outer third to slender elongate acute apices directed ventromesad and posteriorly and crossing at apex, processes appearing cordate in caudal aspect; aedeagal apodeme slender, as long as apical portion of atrial processes, directed anteriorly; aedeagus with posterior margin slightly sinuate, posterior margin of atrial processes smoothly rounded, not angulate.

A short series of three females and four males from Vineland Station, Ontario, collected from *Quercus alba* by W. L. Putman, July 8, 1931, and the holotype, McLean, New York, July 14, 1919, are the only specimens known to exist. The aedeagus of the holotype has been lost.

Types.—Holotype male, in U. S. National Museum Collection, Washington, D. C. A female specimen from the above mentioned series, here designated *neoallotype*, in the Canadian National Collection, Ottawa, Canada.

Ossiannilssonola tunicarubra (Gillette) (*new combination*)

(Pl. LXXV, fig. 3)

Typhlocyba tunicarubra Gillette, Proc. U. S. Nat. Mus., vol. 20, no. 1138, 1898, pp. 752-753.

Erythroneura tunicarubra, Van Duzee, Check List of Hemiptera (excepting the Aphididae, Aleurodidae and Coccidae) of America North of Mexico, 1916, p. 77.

Ossiannilssonia tunicarubra, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *O. clymene* and *O. australis* in structure of male genitalia, but easily distinguished from these species by having anterior half of fore wings bright crimson red, and bases of atrial processes of aedeagus enlarged in caudal aspect.

Length.—3.5-4.0 mm.

Color.—Head, pronotum, and scutellum bright lemon-yellow; fore wings from base to short distance before cross veins crimson red, forming a sharply distinct transverse line posteriorly, remainder of wing yellow, apical cells hyaline; abdomen, dorsum black with outer margins of segments yellow, venter bright lemon-yellow, plates yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin vertical, dorsal margin horizontal, ventral margin obliquely slanting dorsad, dorsal and ventral angles evenly rounded, not produced except for small tooth on mesal margin near dorsal angle, a row of macrosetae along dorsal half of posterior margin.

Internal male genitalia.—Aedeagus with atrial processes short, greatly enlarged laterad on basal third, slightly reduced on median third, greatly reduced to slender, elongate, acute apices directed ventromesad on outer third and crossing at apex, in caudal aspect almost quadrate in outline; aedeagal apodeme slender, as long as apical third of atrial processes, directed ventrocephalad, posterior margin in lateral aspect strongly sinuate, margin of atrial processes smoothly rounded, not angulate.

A short series of specimens of this species were collected from *Quercus alba* by the author in Jefferson County, Kansas, June 15, 1950, including a number of teneral females which show only a slight tinge of pink on the anterior half of the fore wings, and three males of intermediate color intensity. Final instar nymphs collected with these bear wing pads which are also colored pink.

Specimens have been seen from the following localities: *New York:* Conesus Lake, July 16; Ithaca, July 22; *Pennsylvania:* Point Royal, July 24; *Virginia:* Mountain Lake, July 24; *Tennessee:* Knoxville, June 24; Clarksville, July 5; *Ohio:* Delaware County, July 4, 8, 2, 27, August 3; *Michigan:* Agricultural College, July 15; *Wisconsin:* Lake Geneva, July 21; *Iowa:* Ames, July 26; *Kansas:* Douglas County, August; Jefferson County, June 15; Atchison, July 8.

Types.—Holotype female, in the U. S. National Museum Collection, Washington, D. C.; a male specimen compared with holotype, collected by the author in Jefferson County, Kansas, June 15, 1950, here designated *neoallotype*, is in the Snow Entomological Collections of the University of Kansas.

Ossiannilssonola australis (Walsh) (*new combination*)

(Pl. LXXVII, fig. 4)

Erythroneura australis Walsh, The Prairie Farmer, (n. s.), vol. 10, no. 10, September 6, 1862, p. 149.
Typhlocyba australis, Woodworth, Psyche, vol. 5, no. 157-159, 1889, p. 214.

Empoa australis, Van Duzee, Check List of Hemiptera (excepting the Aphididae, Aleurodidae and Coccidae) of America North of Mexico, 1916, p. 77.
Typhlocyba nicarete McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 36. (*new synonymy*)
Ossiannilssonia nicarete, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

This species is not *Empoasca australis* Froggatt (1918), which was subsequently moved into *Typhlocyba* (Myers, 1921), renamed *Typhlocyba froggatti* (Baker, 1925), as a secondary homonym, and has recently been moved to *Edwardsiana* (China, 1950). Synonymy of that species is given on p. 1220 of this paper.

Resembling *O. clymene* externally in lightly colored specimens, and in shape of aedeagus, but differs in having the ventral angle of the pygofer slightly angular and reduced cephalad, and in having ventral margin of atrial processes of aedeagus angular near middle.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum light yellow to yellow; fore wings show marked progressive coloration from whitish-hyaline with only veins yellow, to orange-yellow or deep orange-yellow with longitudinal red band along commissural margin from base of wing to cross veins on inner half of clavus, with a transverse row of three sharply defined black spots in apices of inner three basal cells; abdomen with dorsum black, outer margin of each segment yellow, male plates yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly convex, with dorsal angle evenly rounded, ventral angle reduced forming a slight projection on ventral margin, a row of macrosetae along dorsal half of posterior margin.

Internal male genitalia.—Aedeagus with atrial processes short, stout, tumid on basal two thirds, sharply reduced on outer third to a slender elongate acute apex directed ventromesad posteriorly, in caudal aspect somewhat cordate in outline; aedeagal apodeme slender, as long as outer third of atrial processes, directed anteriorly; posterior margin of aedeagus nearly straight to middle of atrial processes, then abruptly curved dorsocephalad at nearly a right angle.

Numerous specimens of this species have been collected by the author from *Quercus alba* in Milwaukee, Wisconsin. Another large series of this species from Illinois was seen in the Illinois Natural History Survey Collection. *Quercus macrocarpa* has also been recorded as a host plant.

The original description of *Erythroneura australis* Walsh (1862) (nec. *australis* Froggatt, 1918) indicates that this species belongs

in the genus *Ossiannilssonola.* In the absence of a type specimen the author has concluded, after considering all of the species in this genus which might fit the original description, that the majority of specimens of the species *Typhlocyba nicarete* McAtee (1926), which is abundant in Illinois, the type locality of *australis*, fit the limited description more nearly than do specimens of any other species seen.

Specimens have been seen from the following localities: *New York:* Salem, July 27, 28; *Pennsylvania:* Greenberg, August 17; *Virginia:* Blacksburg, Glencarlyn, June 12, 16, 20; Mountain Lake, July 8-26; near District of Columbia, June 15; *Washington, D. C.; Tennessee:* Clarksville, July 11, 29; Tullahoma, August 3; *Ohio:* Delaware County, August 27; Wooster, July 5; Shawnee Forest, June 9; *Minnesota:* St. Paul, June 16, 22, August 6, 11; *Wisconsin:* Milwaukee, June 27; Polk County; *Illinois:* Tinley Park, September 8; Olmsted, July 15; Urbana; Pere Marquette State Park, August 12; Decatur, August; Bell Smith Springs, July 16; Bellwood, June 21; *Missouri:* Goodman, May 28; *Arkansas:* Siloam Springs, May 26; *Oklahoma:* LeFlore County, May 24; *Louisiana:* Ida, June 6.

Types.—The holotype male of *Typhlocyba nicarete* McAtee, White Heath, Illinois, June 24, 1916, here designated *neotype* of *Ossiannilssonola australis* (Walsh), in the Illinois State Natural History Survey Collection; a female specimen taken in copula with a male of this species, July 3, 1950, Milwaukee, Wisconsin, by the author, here designated *neoallotype,* in the Snow Entomological Collections of the University of Kansas.

Ossiannilssonola hinei (Knull) (*new combination*)

(Pl. LXXVII, fig. 5)

Typhlocyba hinei Knull, Ohio. J. Sci., vol. 44, no. 6, 1944, p. 272.
Ossiannilssonia hinei, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *O. volans* in outward appearance, but with anterior crossband at base of fore wings interrupted by white scutellum, and with dorsal angle of pygofer excavated in lateral aspect.

Length.—3.5-4.0 mm.

Color.—Head, pronotum, and scutellum chalky white; fore wings chalky white, subhyaline, with two transverse chocolate-brown bands, one at base of wings interrupted by white scutellum, the other over cross veins formed by a row of four spots in apices of basal cells, veins between spots white, size of spots progressively reduced from inner to outer cell, apical cells whitish-hyaline; abdomen yellow, pygofer yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin vertical on lower two thirds, dorsal third shallowly excavated, dorsal margin broadly produced, with dorsal angle ending in a short, mesally directed spine, ventral angle forming an angular ventrally directed lobe, several submarginal macrosetae near middle of posterior margin.

Internal male genitalia.—Aedeagus with atrial processes elongate, slender, gradually tapering toward apex, curved ventromesad caudally and crossing at apices, in posterior aspect nearly describing a circle; aedeagal apodeme broadly joined to base, enlarged apically into a smoothly rounded club.

According to Mrs. J. N. Knull (1944) this species occurs on *Quercus alba* in association with *O. tunicarubra.*

Specimens have been seen from the following localities: *Ohio:* Delaware County, June 25, July 2, 4, 5; *Tennessee:* Clarksville, July 1; *North Carolina:* Franklin, August 17.

Types.—Holotype female and female paratypes, in the collection of Mrs. J. N. Knull, Columbus, Ohio; one paratype female, in the Herbert Osborn Collection of the Ohio State University; a male specimen, Delaware County, Ohio, July 5, 1945, D. J. and J. N. Knull, here designated *neoallotype,* three *paraallotype* males from Delaware County, Ohio, July 2, 5, 1945, and July 4, 1947, D. J. and J. N. Knull, in the Knull Collection; five *paraallotype* males, Delaware County, Ohio, July 5, 1945 and July 4, 1947, in the Snow Entomological Collections of the University of Kansas.

In his revision of the genus Typhlocyba, (1926), McAtee makes reference to a collection record by Mrs. Annie Trumbull Slosson (1906) from Mount Washington, New Hampshire, of *T. nitidula* (Fabricius), a synonym of *T. bifasciata* Boheman, and on the basis of this record described it as doubtfully occurring in North America, suggesting that the Slosson record might be based on one of the varieties of *Typhlocyba gillettei* or *T. cymba.* It is the opinion of the present author that this record was more likely based upon a specimen of *O. hinei* which was described subsequently, since no specimens of *T. bifasciata* Boheman (nec. *bifasciata* Gillette and Baker, 1895) have been seen from North America.

Ossiannilssonola bangsoni sp. nov.

(Pl. LXXVIII, fig. 1)

Resembling *O. troza* in external appearance, but differs by bearing two short posteriorly-directed spinelike processes on dorsal angle of pygofer.

Length.—3.75 mm.

Color.—Head, pronotum, and scutellum yellowish-white; fore wing yellow with veins lemon yellow, subhyaline to cross veins, apex hyaline and slightly fumose, a transverse row of three black spots in apices of inner three basal cells.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin convexly rounded, dorsal angle produced into a short acute caudally directed hook, a blunt triangular process arising from the mesal margin near dorsal third of posterior margin and directed mesocaudad, ventral angle reduced to a small slightly angular ventrally directed lobe, without macrosetae near outer basal angle of plate, a few macrosetae on posterior margin along concavity between processes.

Internal male genitalia.—Style with apex appearing somewhat truncate, with small triangular projection on lateral margin near apex, aedeagus with base greatly enlarged, atrial processes shorter than base, gradually narrowed from base to apex, directed ventromesad posteriorly, nearly meeting at apex, in lateral aspect with ventral margin of basal two thirds produced medially forming nearly a right angle, apical third abruptly recurved ventrad; aedeagal apodeme reduced to a broad triangular anteriorly directed process in lateral aspect.

This species is known from two male specimens both of which were taken at light, and was doubtfully referred to as *O. quadrata* (DeLong and Johnson) by Medler (1942).

Types.—Holotype male, Berea, Kentucky, July 4, 1941, J. S. Bangson, in the U. S. National Museum Collection; one paratype male, Ramsey County, Minnesota, U. Farm Light, July 8, 1921, collected by Wm. E. Hoffman, in the University of Minnesota Collection. Since its description by Medler, and prior to its being sent to the author, the body of the paratype was lost from the point, but the dissection of the abdomen is complete, and in view of the clear description of the specimen by Dr. Medler which agrees in every particular with that of the holotype, it has been made a paratype even though it is not now complete.

Ossiannilssonola duplicata (McAtee) (*new combination*)

(Pl. LXXVIII, fig. 2)

Typhlocyba duplicata McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 16-17. (nec. *T. duplicata* Jacobi, 1941) (*Typhlocyba jacobii*, nom. nov. for *Typhlocyba duplicata* Jacobi, see p. 1107.

Ossiannilssonia duplicata, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *Empoa casta* in color pattern, but with ground color

milky white, and without macroseta near base of plate; dorsal angle of pygofer produced as a broad distinctly quadrate process.

Length.—3.0 mm.

Color.—Head, pronotum, and scutellum milky white to light yellowish white; fore wings milky white, with brown markings forming two transverse bands, one near middle of wing variable in width from a trace of a line in partly teneral specimens to a band one fourth the width of wing, the other band over cross veins made up of six spots, one in each of the inner three basal and first, second, and fourth apical cells; abdomen, dorsum black with apical half of each segment white to yellow; venter yellow, plates light yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin sinuate on lower two thirds, dorsal third produced dorsocaudad beyond ventral angle as a broad quadrate process bearing two mesally directed diverging spines, ventral angle directed ventrad in a broad lobe slightly constricted near apex, a few macrosetae along posterior margin of quadrate process.

Internal male genitalia.—Aedeagus with atrial processes elongate, broad at base, gradually reduced to acute apices, outer margins quadrate from posterior aspect, apices directed mesad toward each other, widely separated, in lateral aspect sinuate, curved anteriorly near middle, apex directed dorsad; aedeagal apodeme similar to that of *O. hinei,* enlarged apically.

Several hundred specimens of this species were collected by the author from *Crataegus* sp. in Milwaukee, Wisconsin, June 26-July 4. The type series, from Toronto, Ontario, August 8, the only other specimens known, have been seen by the author.

Types.—Holotype male, allotype female, and female paratypes, in the U. S. National Museum Collection.

This species shows the same type of color variability due to varying degrees of maturity, as *O. appendiculata, O. volans,* species of *Empoa,* and heavily marked species of *Typhlocyba.*

Ossiannilssonola serrula (Ross and DeLong) (*new combination*)

(Pl. LXXVIII, fig. 3)

Typhlocyba serrula Ross and DeLong, Ohio J. Sci., vol. 49, no. 3, 1949, pp. 117-118.

Ossiannilssonia serrula, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *Typhlocyba niobe* and *T. persephone* in outward appearance, but distinguished from these by its larger size and absence of macrosetae on outer basal angle of male plate; distinguished

from other species of *Ossiannilssonola* by lacking brown markings anterior to cross veins in inner three basal cells, and by having apices of atrial processes of aedeagus serrate.

Length.—3.5-3.75 mm.

Color.—Head, pronotum, and scutellum light yellow; fore wings sulfur yellow, yellow-orange to nearly red-orange in some specimens, subhyaline to shortly before cross veins, without black or brown spots anterior to cross veins, areas occupied by spots in other species hyaline; apical cells hyaline; apical veins sulfur yellow; hind wing with veins yellow; abdomen and plates entirely yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin straight, slightly slanting toward base of plate; dorsal angle rounded, with a short, acute, dorsomesally directed spine, another similar spine on mesal margin, slightly lower; ventral angle a broad evenly rounded ventrally projecting lobe, a few slightly submarginal macrosetae near dorsal posterior margin.

Internal male genitalia.—Aedeagus with atrial processes elongate, slender, apices almost meeting mesally, in posterior aspect diverging to outer third, then broadly curved mesad toward each other, finely serrate at apex, in lateral aspect apical third bent ventrocaudad, processes joining base of aedeagus at an acute angle; aedeagal apodeme short, curving caudad, closely appressed to base of aedeagus.

A large series of specimens has been collected by the author from *Acer saccharum* in association with the similarly colored species *Typhlocyba niobe*, *T. persephone*, *T. athene*, and *Edwardsiana lethierryi*. Specimens have been seen from Gatlinburg, Tennessee, June 21, 28; Milwaukee, Wisconsin, June 28-July 5; and the type series from Waynesburg, Pennsylvania, July 17; and North Bloomfield, Pennsylvania, July 16.

Types.—Holotype male, allotype female, and female paratypes, in the DeLong Collection, Columbus, Ohio; one male paratype, in the Illinois State Natural History Survey Collection.

Ossiannilssonola mcateei sp. nov.

(Pl. LXXVIII, fig. 4)

Resembling *O. danae* in external appearance, but with apex of style acute, not truncate; pygofer with dorsal angle a broad blunt projection.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum pale white to light yellow; fore wing with a transverse row of three black spots in apices

of inner three basal cells, apical cells slightly fumose; abdomen white, male plates white.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly transverse, dorsal angle produced into a broad blunt mesally directed projection, ventral angle somewhat angular, apically rounded, a few macrosetae on dorsocaudal margin.

Internal male genitalia.—Style with acute apex; aedeagus with atrial processes slender, elongate, sharply bent ventromesad caudally, crossing near apex, in caudal aspect quadrate, in lateral aspect evenly curving dorsad to middle then sharply bent ventrocaudad; aedeagal apodeme short, indistinct.

This species was first recorded under the name *Typhlocyba eurydice* by McAtee (1926), from a male specimen from Odenton, Maryland, July 12, 1914, which was made a paratype of *eurydice*. The holotype, allotype, and paratype females of *eurydice* from Beltsville, Maryland, June 23, 1916, seen by the author, are specimens of *O. danae* agreeing with the holotype of that species. On the basis of specimens compared with the type, Ross and DeLong (1949) published a description of *eurydice* which agrees with the holotype. The original descriptions of both species occur on p. 37 (McAtee, 1926), but since the description of *O. danae* precedes that of *O. eurydice,* the latter is here recognized as a synonym of *O. danae* (McAtee).

Types.—Holotype male, Odenton, Maryland, July 12, 1914, W. L. McAtee, (paratype of *T. eurydice*) in the U. S. National Museum Collection, Washington, D. C.; allotype female, and one pair of paratypes, Bell Smith Springs, Illinois, July 16, 1947, L. J. Stannard, from *Quercus alba,* and two male paratypes, Palos Park, Illinois, June 22, 1949, Ross and Stannard, from *Quercus alba,* in the Illinois State Natural History Survey Collection; one female and two male paratypes, "Ohio Pl.," Pennsylvania, July 19, 1919, D. M. DeLong, and one pair of paratypes, Northeast, Pennsylvania, July 4, 1918, D. M. DeLong, in the Collection of D. M. DeLong, Columbus, Ohio. One male, from Berea, Kentucky, June 28, 1941, J. S. Bangson, is recognizable as this species, but is in too poor condition to be made a paratype.

Ossiannilssonola danae (McAtee) (*new combination*)

(Pl. LXXVIII, fig. 5)

Typhlocyba danae McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 37.
Typhlocyba eurydice McAtee, *op. cit.*, pp. 37-38. (*new synonymy*)
Ossiannilssonia danae, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.
Ossiannilssonia eurydice, loc. cit.

Resembling *O. mcateei* in external appearance, but with apex of style appearing truncate; pygofer with dorsal angle acute and with two acute horizontally arranged spines visible in caudal aspect.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum milky white; fore wings milky white, subhyaline nearly to cross veins, with a transverse row of three indistinct brown spots in apices of inner three basal cells; abdomen white; male plate white.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin obliquely slanted from dorsal angle to base of plate, dorsal angle produced in an acute mesally-directed spine, a similar spine arising from the mesal margin, ventral angle a large tongue-shaped lobe arising from mesal margin near dorsal third of pygofer, a few macrosetae on posterior margin of dorsal angle.

Internal male genitalia.—Style with a sharp subapical triangular projection on mesal margin; aedeagus with atrial processes elongate, slender, sharply bent ventromesad posteriorly, crossing near apex, strongly divergent on basal half, apical halves bent at right angles toward each other, directed ventrocaudad; aedeagal apodeme elongate, slender, curving dorsocephalad.

A large series of specimens of this species has been collected by the author from *Quercus alba* in Milwaukee, Wisconsin, in association with *O. berenice* and *O. australis.*

The synonymy of this species is discussed under *O. mcateei,* pages 1148-1149.

Specimens have been seen from the following localities: *New York:* Conesus Lake, July 16; *Maryland:* Beltsville, June 23; *Virginia:* Glencarlyn, June 12, 16, 20, 23; *Wisconsin:* Milwaukee, June 30-July 7; *Illinois:* Palos Park, June 22.

Types.—Holotype male, allotype female, and a pair of paratypes from Conesus Lake, New York, in the Snow Entomological Collections of the University of Kansas; nine paratypes from Glencarlyn, Virginia, in the U. S. National Museum Collection. All type specimens have been seen.

Ossiannilssonola appendiculata (Malloch) (*new combination*)

(Pl. LXXIX, fig. 1)

Typhlocyba appendiculata Malloch, Canadian Ent., vol. 52, no. 4, 1920, p. 95.
Ossiannilssonia appendiculata, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.
Typhlocyba gillettei var. *sellata* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 29. (*new synonymy*)
Typhlocyba querci var. *sellata,* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 103.

Resembling *O. phryne* in having male plate bilobed near apex, but differing by not having black or brown markings on head, pronotum, or scutellum; pygofer with posterior margin almost vertical.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum light yellow; fore wings with ground color light yellow, subhyaline to near cross veins; with variable amounts of brown color forming rather indistinct patterns, lightly colored specimens with brown markings in outer fourth of inner three basal cells forming almost a solid band, with a dash of brown along basal half of claval suture, color irregular in intensity, progressively increasing in area, darkly marked specimens with most of the wing anterior to cross veins brown, a yellow semicircle along basal third of costal vein and another along middle of costal vein extending inward to middle of third basal cell, apices of third and fourth basal cells yellow; apical cells hyaline, slightly fumose.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin almost vertical, slightly projecting on dorsal angle, smoothly rounded, ventral margin forming nearly a right angle with posterior margin, a number of macrosetae submarginally arranged near dorsal posterior margin; plates with a short laterally directed lobe at outer third (Pl. LXXIX, fig. 1f).

Internal male genitalia.—Style with apex more elongate than usual (Pl. LXXIX, fig. 1e); adeagus with atrial processes elongate, slender, sinuate, gradually tapering from base to acute apices which are sharply directed mesad on outer third, crossing at apex medially, in caudal aspect nearly quadrate, in lateral aspect slightly sinuate; aedeagal apodeme slender, elongate, slightly enlarged apically, directed cephalad.

A large series of specimens has been taken from *Quercus macrocarpa* in Milwaukee, Wisconsin, and several other series from the same host taken by H. H. Ross and L. J. Stannard in Illinois, are at hand.

Specimens have been seen from the following localities: *New York:* Batavia, July 4, August 12; Norris, August 15; New York City Botanic Garden, July 7; *Pennsylvania:* Hartstown Bog, August 13; *Washington D. C.* June 18, 29; *Tennessee:* Great Smoky Mountain National Park, June 12; *Ohio:* Barberton, August 13; *Illinois:* Cook County—Palos Park, June 22; Urbana, July 9, 14; Tinley Park, September 8; Thornton, September 7; *Iowa:* Ames, June 19, September 11; *Kansas:* Manhattan, June 8; *Wisconsin:* Madison, July 19; Mil-

waukee, June 26-July 4; *Minnesota:* Ramsey County, July 20, 26; August 3, 25.

Both the holotype female and female paratype of McAtee's *Typhlocyba gillettei* var. *sellata* have been seen, and are identical in color marking with heavily pigmented specimens of this species.

Types.—Holotype male, allotype female, and one paratype male in the Illinois State Natural History Survey Collection. Types have been seen by the author.

Ossiannilssonola phryne (McAtee) (*new combination*)

(Pl. LXXIX, fig. 2)

Typhlocyba phryne McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 34-35.
Typhlocyba phryne var. *subpulchra* McAtee, *loc. cit.*
Ossiannilssonia phryne, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *O. appendiculata* in the shape of male plate, but differing by having a black line along commissural margin and parenthesis-shaped black lines on scutellum, pronotum, and sometimes extending onto head; pygofer strongly produced caudally on dorsal half as a broad apically rounded lobe.

Length.—3.5 mm.

Color.—Head, in very darkly marked specimens, with two chocolate brown longitudinal bars on either side of midline from anterior margin of eye to pronotum, ecdysial line dark, remaining portions yellow, entirely yellow in most specimens; pronotum, with two parenthesis-shaped chocolate brown longitudinal bands continuing posteriorly from basal margin of head broadening caudally and nearly meeting medially at base, with remaining portions yellow, almost entirely yellow in lightly marked specimens with only a faint trace of chocolate brown color; scutellum, with lateral angles chocolate brown, yellow medially; fore wings, with chocolate brown stripes along commissural margin to cross veins covering inner half of clavus, chocolate brown spots in apices of inner three basal cells forming a transverse band; size of spots progressively smaller towards costal margin, lighter areas anterior to cross veins subhyaline, yellowish-white; apical cells hyaline, fumose; abdomen, chocolate brown on basal half of median third of dorsal segments, laterally deep orange yellow, dorsal third of pygofer chocolate brown, venter yellow, plates yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin greatly produced caudally on dorsal half, ventral angle forming a right angle, with one or usually two macrosetae just

dorsad of outer basal angle of plate, a row of macrosetae along posterior margin on dorsal half; male plate elongate, dorsoventrally compressed near middle, forked shortly before apex into two thumb-like processes, one directed dorsad, the other laterad, setae mostly restricted to outer fourth. (Pl. LXXIX, fig. 2a).

Internal male genitalia.—Aedeagus with atrial processes elongate, slender, apices directed mesocaudad, separated at apex, in caudal aspect nearly forming a circle; aedeagal apodeme reduced to a broad triangular anteriorly directed process.

A large series of specimens of this species collected by H. H. Ross and L. J. Stannard, from *Quercus macrocarpa,* in Illinois, has been seen by the author.

Specimens have been examined from the following localities: *New York:* Norris, August 15; *Ontario:* Ottawa, June 30, September 27; *Illinois:* Western Springs, June 21; Tinley Park, September 8; *Wisconsin:* Milwaukee, June 27; *Minnesota:* St. Paul, June 22-23, August 12, 18, 25.

Types.—Holotype female, in the Illinois State Natural History Survey Collection; another female holotype of var. *subpulchra,* in the Iowa State College Collection; a male specimen collected by the author, June 27, 1950, Milwaukee, Wisconsin, here designated *neoallotype,* two *paraallotype* males, June 21, 1949, Western Springs, Illinois, Stannard and Ross, and three *paraallotype* males, June 16, 1949, Tinley Park, Illinois, Ross and Stannard, in the Snow Entomological Collections of the University of Kansas; additional *paraallotype* males: five, June 21, 1949, Western Springs, Illinois, Stannard and Ross; eight, September 8, 1949, Tinley Park, Illinois, Ross and Stannard, in the Illinois State Natural History Survey Collection; one, August 15, 1942, Norris, New York, R. E. Olson, in Cornell University Collection; one, August 12, 1938, St. Paul, Minnesota, A. A. Granovsky, in the University of Minnesota Collection; one, September 8, 1904, Ottawa, Ontario, W. Metcalfe, in the Colorado Agricultural and Mechanical College Collection.

Ossiannilssonola rossi sp. nov.

(Pl. LXXIX, fig. 3)

Resembling *O. quadrata* and *O. knulli* in external appearance and in general form of pygofer and aedeagus, but distinguished from these species by having the dorsal angle of pygofer greatly produced into a large hook, and in having the apices of the atrial processes appearing forked in caudal aspect.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum light yellow; fore wings, light yellow, subhyaline to near cross veins, apex hyaline and slightly fumose, with a transverse row of three clearly defined black spots in apices of inner three basal cells; abdomen black on dorsum, venter light.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin distinctly S-shaped on lower half, dorsal angle produced posteriorly in a broad ventrally hooked lobe, curving mesad, and appearing as a broad hook in caudal aspect as well, ventral angle rounded, reduced, a dense brush of macrosetae on dorsal lobe.

Internal male genitalia.—Aedeagus with atrial processes elongate, slender, apices distant from each other the width of base, in caudal aspect subquadrate, slightly diverging toward apex, sharply bent mesad on apical fourth, with apices flattened and twisted dorsocaudad, appearing forked; base of aedeagus roughly S-shaped from left side; aedeagal apodeme reduced to a slight projection on anterior margin.

Type.—Holotype male, Thornton, Illinois, June 22, 1949, H. H. Ross and L. J. Stannard, on *Quercus bicolor*, in the Illinois State Natural History Survey Collection.

Ossiannilssonola knulli sp. nov.

(Pl. LXXIX, fig. 4)

Resembling *O. quadrata* in external appearance, but with dorsal angle of pygofer less prominent, and with base of aedeagus not broadly inflated below bases of atrial processes.

Length.—3.0-3.25 mm.

Color.—Head, pronotum, and scutellum bright sulfur-yellow; fore wings sulfur-yellow, subhyaline to cross veins, apex hyaline, slightly fumose, with a transverse row of three black spots in apices of inner three basal cells, sometimes one or two missing; abdomen yellow, male plates yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margins somewhat S-shaped on lower half, dorsal angle directed caudally as a broad ventrally hooked lobe one fourth as long as broad, hook more prominent from caudal aspect, ventral angle broadly rounded, a group of macrosetae on dorsal posterior margin.

Internal male genitalia.—Style abruptly reduced to an acute apex (Pl. LXXIX, fig. 4), with atrial processes elongate, slender, slightly curved ventromesad caudally, crossing near apex; base of aedeagus roughly S-shaped in lateral aspect; aedeagal apodeme reduced to a

slight projection on anterior margin; base of aedeagus slender in caudal aspect, not enlarged as in *O. quadrata.*

A large series of both male and female specimens has been collected by the author, from a single tree of *Quercus borealis* in Lawrence, Kansas.

Types.—Holotype male and numerous paratypes of both sexes, Douglas County, Kansas, June 8, 1951; allotype female, two male and twenty-one female paratypes, Douglas County, Kansas, June 10, 1950; ten female paratypes Douglas County, Kansas, June 12, 1950, P. J. Christian, in the Snow Entomological Collections of the University of Kansas; one male paratype collected by Nathan Banks, North Mountain, Pennsylvania, July 4, in the Museum of Comparative Zoology; a pair of paratypes collected by E. D. Ball, Woods Hole, Massachusetts, July 7, 1925, in the U. S. National Museum Collection; one female, June 12, and pair of paratypes June 20, 1951, Dale Bray, Wilmington, Delaware, in the University of Delaware Agricultural Experiment Station Collection.

Ossiannilssonola quadrata (DeLong and Johnson) (*new combination*)

(Pl. LXXX, fig. 3)

Typhlocyba quadrata DeLong and Johnson, Ent. News, vol. 47, no. 4, April, 1936, pp. 102-104.
Ossiannilssonia quadrata, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *O. knulli* in outward appearance, but with dorsal angle of pygofer more prominent, hook terminating in strong, acute, ventrally-directed spine, base of aedeagus laterally inflated below bases of atrial processes.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum pale yellow; fore wings yellow, subhyaline to cross veins, with a transverse row of three black spots in apices of inner three basal cells; apex fumose, hyaline.

Genital capsule.—Male pygofer, in lateral aspect, with lower half of posterior margin less distinctly S-shaped than in *O. rossi,* dorsal angle produced caudally into a short broad process curving ventrad as a sharp elongate spine and with another shorter spine directed mesad near dorsal margin, a few submarginal macrosetae on dorsal angle, ventral angle broadly rounded but less prominent than in preceding species.

Internal male genitalia.—Style with apex less abruptly reduced than in *O. knulli* (Pl. LXXIX, fig. 4e); aedeagus with atrial processes elongate, slender, directed ventromesad caudally; aedeagal apo-

deme absent; base of aedeagus greatly inflated laterally, sharply constricted before bases of atrial processes, with a sclerotized plate extending over bases of processes into membrane.

Type.—This species is known from one male specimen collected at Kane, Pennsylvania, August 19, 1928, by D. M. DeLong, and is in the collection of the collector. Illustrations for this species have been drawn from the type specimen.

Ossiannilssonola troza (Ross and DeLong) (*new combination*)

(Pl. LXXX, fig. 1)

Typhlocyba troza Ross and DeLong, Ohio J. Sci., vol. 49, no. 3, 1949, pp. 116-118.

Ossiannilssonia troza, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Resembling *O. bangsoni* in external appearance, but with dorsal angle of pygofer produced as a broad, acute, dorsomesally-directed arm.

Length.—3.5-3.75 mm.

Color.—Head, pronotum, and scutellum white to light yellow; fore wings, light yellow to yellow, subhyaline to cross veins, with a transverse row of three black spots in apices of inner three basal cells, apex hyaline, slightly fumose; abdomen yellow, male plates yellow.

Genital capsule.—Male pygofer, in lateral aspect with posterior margin nearly transverse, dorsal angle produced into a large broad dorsomesally directed hook, ventral angle slightly produced caudally in a short hook, a row of macrosetae on posterior margin of dorsal hook.

Internal male genitalia.—Aedeagus with atrial processes elongate, slender, apices separated, in caudal aspect nearly quadrate in outline, widely separated near basal third, slightly converging to outer third which is abruptly curved mesodorsad caudally; aedeagal apodeme short, enlarged apically, directed dorsad.

In addition to the holotype, a short series collected by R. H. Beamer and the author, from *Quercus muhlenbergii,* and one male taken on *Quercus palustrus* by the author, in Douglas County, Kansas, June 11-24, have been seen.

Types.—Holotype male, in the Illinois State Natural History Survey Collection; a female specimen collected by R. H. Beamer, Douglas County, Kansas, June 11, 1949, taken with males of this species, here designated *neoallotype,* in the Snow Entomological Collections of the University of Kansas.

Ossiannilssonola flavomarginata (Gillette and Baker) (*new combination*)

(Pl. LXXX, fig. 2)

Typhlocyba flavomarginata Gillette and Baker, Bull. Colorado Agr. Exp. Sta., no. 31, Tech. ser. no. 1, 1895, pp. 111-112.
Typhlocyba flavomarginata var. *vesta* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 18.
Typhlocyba flavomarginata var. *scorta* McAtee, *op. cit.*, pp. 18-19.
Typhlocyba flavomarginata var. *media* McAtee, *op. cit.*, p. 19.
Ossiannilssonia flavomarginata, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 99.

Specimens of Form I which have a red longitudinal stripe on clavus along commissural margin, resemble in external appearance deeply colored species of *O. australis,* but are easily distinguished from this species and other species in the genus by having styles with apical third sharply curved mesad, and a triangular projection on lateroventral margin.

Length.—3.25-4.0 mm.

Color.—The color of this species is highly variable resulting in five recognizable forms, but with numerous intermediates of all degrees between these. Perhaps a study of the genetic constitution of this species will be necessary before the diversity of color pattern will be understood.

Color descriptions of the five most distinct patterns, designated by Roman numerals I to V, are as follows:

Form I.—Head light yellow; pronotum yellow with a red triangle with apex on disc and base on posterior margin; scutellum with outer angles red, forming an inverted V with the triangle on pronotum; fore wings with red commissural band extending from base to cross veins on inner half of clavus, with a dark spot in each of inner three basal cells appearing as a band obliquely slanted caudally toward costal margin, remaining portions of wing anterior to cross veins subhyaline, yellow, apex hyaline, fumose; abdomen with dark brown median band on dorsum broader on basal segments, sides yellow, venter and male plates yellow.

Form II.—Head, yellowish-white; pronotum yellow, light brown from disc to posterior margin; scutellum light brown; fore wings light to dark brown, hyaline, without spots; abdomen with median band on dorsum dark brown, sides bright yellow, venter and male plates yellow.

Form III.—Head, pronotum, and scutellum bright yellow; fore wings pale red throughout, subhyaline to cross veins, hyaline beyond; abdomen and male plates yellow.

Form IV.—Head yellow-orange; pronotum yellow-orange, disc orange; scutellum yellow-orange; fore wings deep orange throughout, subhyaline to cross veins, hyaline beyond; abdomen and male plates yellow.

Form V.—Head, pronotum, scutellum, and all of fore wings white to ivory, without dark markings.

All degrees of color intergradation can be found between forms I and II, I and V, and II and V. Some intergrades occur between III and IV, and there is a gradation through teneral specimens of III and IV, toward V. The holotype of McAtee's var. *media* is like form I, the holotype of var. *scorta* is like form III, and the holotype of var. *vesta* is like form V. The lectotype of var. *flavomarginata* is intermediate between forms II and V, but nearer form II.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly vertical, ventral margin extended dorsad obliquely nearly to dorsal angle; dorsal angle broadly rounded, ventral posterior margin slightly recurved, with a slight, papillose, ventral lobe, a number of macrosetae on dorsal posterior margin; male plate in ventral aspect, wedge-shaped, lateral and mesal margins nearly straight, in lateral aspect slightly curved dorsad, with a broad dorsolateral excavation on outer three fourths.

Internal male genitalia.—Styles with outer third of apical portion abruptly curving mesad, a small triangular hooklike projection on lateroventral margin (Pl. LXXX, fig. 2e); aedeagus with atrial processes broadly flattened laterally on basal two thirds, reduced on apical third to slender mesoventrally curving acute apices, directed caudally; aedeagal apodeme in lateral aspect broad, elongate, apically enlarged, directed cephalad.

Female.—With posterior margin of eighth abdominal sternite strongly incised laterally forming two lateral lobes and one slightly emarginate median lobe (Pl. LXXXVII, figs. 7a, b).

Two large series collected by R. H. Beamer in Sapello, New Mexico, and in Raton, New Mexico, from *Quercus sp.*, have been seen by the author, and short series have been seen from the following localities: *Arizona:* Grand Canyon, August 1, 3, 11; Flagstaff, August 1, 5; Oak Creek Canyon, July 9, 31, August 9, 14; Coconino County, August 13; Huachuca Mountains, July 8, August 1, 2; Cochise County, July 29; *New Mexico:* Ruidoso, August 10, October 10, 15; Pecos, Sapello, July 24; Raton, July 26; Jamez Springs, July 22; Taos Pass, August 13; Cimarron, August 13; Colfax County, August 21; Cowles, July 18; Luna, July 25; Soroco County, August

18; *Colorado:* LaVeta Pass, July 28; Colorado Springs, July 19; Palmer Lake, October 9; Trinidad, July 13, August 19; Manitou, September 29; Cimarron, August 22; Cerro Summit, August 21; Durango, August 7; Salida, October 8; Alder, August 25; Rabbit Ear Pass, August 18; Royal Gorge, July 3; Glenwood Springs, August 17; Garden of the Gods; Colorado City; *Utah:* Freedom, August 24, Fruitland, July 16; Keetley, August 16; Park City, August 16; Grant, June 25, July 4, 14, 15, 22, 24, August 6; Farmington, June 12; Panguitch, September 4; Alton, July 30, August 14; Salt Lake City, July 3, 13, August 29; Emery, August 16; Cove Fort, August 14; Cedar City, August 13; Pintura, August 11; Salina, August 13, 26; Fish Lake, September 2; Richfield, July 14; Mount Carmel Highway, June 18.

Types.—Specimens seen bearing machine printed cotype labels are as follows: two specimens, "Colo 2280" in the Snow Entomological Collections of the University of Kansas; four specimens, "Colo 2280" and one specimen, "Colo 2266" in the Colorado Agricultural and Mechanical College Collection; and two specimens, "Colo 2266" and "Colo 2270" in the U. S. National Museum Collection. Two female specimens each bearing a handwritten label "type" on white paper, have also been seen, one "Colo 1375" in the U. S. National Museum Collection, and the other "Colo 1780" in the Colorado Agricultural and Mechanical College Collection. These numbers refer to the collecting numbers of either Baker or Gillette and have been checked on the lists of each of these men, for the data which the numbers represent.

The data for number 1780 on Gillette's list which fits that given for the three females in the original description of *T. flavomarginata* G. & B., is "9-29-'94, at Manitou, Colo. C.P.G., *Quercus undulosa*". The data for each of the other numbers seen indicates that the specimens bearing these can not be more than metatypes.

In 1926 McAtee selected a lectotype from three females which he thought were the type series of *flavomarginata,* and designated a fourth specimen, a male with a cotype label on it, as *neoallotype,* recognizing that it was not a cotype since only females were in the type series. These specimens were given the U.S.N.M. catalogue number 3456, and placed in the U. S. National Museum Collection. Only three of these four specimens are now in this collection, and of these, two, "Colo 2270" a female, and "Colo 2266" a male, bear cotype label U.S.N.M. 3456. The male is unquestionably the *neoallotype* set up by McAtee while the other specimen is only a

metatype. The third specimen, "Colo 1375" which on Baker's list is "May, Ft. Collins", may have been the specimen selected by McAtee as lectotype, since it does not bear a U.S.N.M. cotype label as the others do, although it does *not* have a lectotype label either. There is also the possibility that the fourth specimen seen by McAtee may have been the one selected as lectotype, but this specimen is now missing.

Since the only remaining specimen which could have been selected as lectotype, "Colo 1375", is not one of the type series, and since only one specimen of the type series is now known to exist, the author proposes that this specimen, "Colo 1780" in the Colorado Agricultural and Mechanical College Collection, be made lectotype of *Typhlocyba flavomarginata* Gillette and Baker.

GENUS TYPHLOCYBA Germar

(Pls. LXXXI-LXXXVII)

Typhlocyba Germar, Rev. Ent. Silbermann, vol. 1, 1833, p. 180.
Anomia Fieber, Verh. Zool.-bot. Ges. Wien, vol. 16, 1866, p. 509. (type, *Cicada quercus* Fabricius, 1794, by subsequent designation of Evans, 1947, Trans. Roy. Ent. Soc. Lond., vol. 98, p. 200). Type of the genus, *Cicada quercus* Fabricius, by subsequent designation of Woodworth, 1889.

Fore wings.—Inner and outer apical cells short, not attaining wing apex; second apical cell much broader at apex than at base; third apical cell petiolate; wing apex smoothly rounded. (Pl. LXXXI, fig. 1f).

Hind wings.—Vein 1V branching from 2V near its midlength; submarginal vein absent at wing apex; both apical cells open apically; posterior branch of R fused with apical portion of vein M_{1+2} (Pl. LXXXI, fig. 1f).

Genital capsule.—Male plate gradually curved dorsad apically, reduced near middle but enlarged apically, with one or rarely two macrosetae near outer basal angle, submarginal row of microsetae near outer basal angle, submarginal row of microsetae parallel to lateral margin near middle and extending over apical half of length, a few other irregularly arranged microsetae, apex usually black; pygofer, in lateral aspect, of various forms with or without sclerotized barlike thickenings which when present may or may not be extended as caudal or dorsocaudal pygofer processes, with ventrocaudal margin occasionally inrolled, often with group of macrosetae just dorsad of outer basal angle of male plate, almost always with group of small submarginal setae along dorsocaudal margin and with numerous microsetae arranged over disc; apex of ventral lobe or ventral hook usually black.

Internal male genitalia.—Style elongate, slender, usually either smoothly curved laterad or dorsad apically, with mesal preapical protruberance poorly developed or absent in broad aspect (which may be dorsal or caudal); style with setae in various arrangements; connective massive, the aedeagal articulation subterminal; aedeagus with preatrial arm well developed or not, apodeme usually well developed; aedeagal shaft with paired ventral processes arising from atrium or base of shaft, sometimes fused to shaft, with one or two pairs of apical processes and occasionally with processes along length of shaft.

Head in dorsal aspect narrower than pronotum, longer medially than next the eye, anterior margin of crown broadly rounded; pronotum short and broad, lateral margins strongly divergent caudally, posterior margin smoothly, shallowly convex, pleural portion broader than ocellocular area.

The species, for the most part, are slender and delicate in appearance, usually pale white or yellow, occasionally with darker markings.

The genus is holarctic in distribution.

The following key to the North American species of the genus is based primarily on characteristics of the male genitalia.

KEY TO THE SPECIES OF TYPHLOCYBA

1. Aedeagus with atrial processes arising from base of shaft 2
   Aedeagus without atrial processes, or with processes fused to shaft 20
2. Atrial processes fused with aedeagal shaft on basal fourth 3
   Atrial processes arising from near, or at the base of aedeagal shaft 4
3. Aedeagal shaft with elongate apical processes (Pl. LXXXI, fig. 3b, c) ..... *athene* p. 1166
   Aedeagal shaft simple, without apical processes (Pl. LXXXV, figs. 2b, c) ..... *cassiopeia* p. 1181
4. Aedeagal shaft with processes 5
   Aedeagal shaft without processes 7
5. Aedeagal shaft with two pairs of processes (Pl. LXXXIV, fig. 3b, c) ..... *shawneeana* p. 1178
   Aedeagal shaft with one pair of processes 6
6. Aedeagal shaft processes apical, broad at base, short and stout, slightly curving laterad. (Pl. LXXXI, fig. 2b, c) ..... *oneka* p. 1165
   Aedeagal shaft processes slightly subapical, elongate, slender, curving strongly laterodorsad. (Pl. LXXXI, fig. 4b, c) ..... *arsinoe* p. 1166
7. Aedeagal shaft flattened laterally and apically into a broad thin semitransparent plate 8
   Aedeagal shaft not flattened laterally and apically 12

8. Posterior margin of pygofer projecting ventrad as a long sharp hook; face of males usually orange-red. (Pl. LXXXII, fig. 4), *pomaria* p. 1170
   Posterior margin of pygofer not projecting ventrad as a long sharp hook; face never orange-red 9
9. Dorsal angle of pygofer forming a prominent caudally directed process 10
   Dorsal angle of pygofer not forming a prominent caudally directed process 11
10. Dorsal process of pygofer narrow, acute, heavily sclerotized. (Pl. LXXXIII, fig. 3) ..... *surcula* p. 1175
    Dorsal process of pygofer a broad continuation of pygofer, not heavily sclerotized. (Pl. LXXXIII, fig. 1) ..... *attenuata* p. 1172
11. Posterior half of pygofer nearly quadrate; fore wing white, without markings. (Pl. LXXXIII, fig. 4) ..... *andromache* p. 1176
    Posterior half of pygofer with margin strongly rounded; fore wing with a broad brown band over cross veins, often with a red spot in middle. (Pl. LXXXIII, fig. 2) ..... *rubriocellata* p. 1174
12. Apex of male plate produced laterally as a short, heavily sclerotized, beaklike process (Pl. LXXXI, fig. 1); fore wings with five red to orange-brown spots, and with brown markings in cells bordering cross veins ..... *quercus* p. 1163
    Apex of male plate smoothly rounded; fore wings without red or orange markings 13
13. Atrial processes of aedeagus broadly flattened. (Pl. LXXXIV, fig. 1) ..... *melite* p. 1176
    Atrial processes of aedeagus not broadly flattened 14
14. Aedeagal shaft arising greatly elevated above bases of atrial processes 15
    Aedeagal shaft arising between or slightly above bases of atrial processes 16
15. Atrial processes of aedeagus fused on basal fourth, or basal half; style with thumblike projection on lateral margin near middle; pygofer with a short, acute, dorsally directed hook. (Pl. LXXXII, fig. 1) ..... *modesta* p. 1167
    Atrial processes of aedeagus not fused on basal fourth, style without thumblike projection near middle; pygofer with a long, sharp, ventrally directed process on ventral angle. (Pl. LXXXII, fig. 3) ..... *hockingensis* p. 1169
16. Fore wings with a transverse brown or black band 17
    Fore wings without dark transverse band 18
17. Fore wings with band distad of cross veins; shaft of aedeagus with posterior margin concave; dorsal angle of pygofer forming a broad, angular, laterally-concave process. (Pl. LXXXIV, fig. 2) ..... *alabamaensis* p. 1177
    Fore wings with band covering middle third; shaft of aedeagus convex on posterior margin; dorsal and posterior margins of pygofer nearly continuous, not produced. (Pl. LXXXIV, fig. 4) ..... *transviridis* p. 1179

18. Aedeagus with atrial processes not exceeding shaft in length; pygofer with a small ventrally directed lobe near middle of posterior margin. (Pl. LXXXII, fig. 2) ..... *medleri* p. 1169
Aedeagus with atrial processes exceeding shaft in length by one third their length 19
19. Aedeagal shaft anterior to atrial processes throughout its length; posterior margin of pygofer nearly straight, without short ventral tooth. (Pl. LXXXV, fig. 3) ..... *crassa* p. 1182
Aedeagal shaft posterior to or even with atrial processes; pygofer with posterior margin angled near middle, extended ventrad as a short tooth. (Pl. LXXXV, fig. 1) ..... *putmani* p. 1180
20. Aedeagus with two pairs of shaft processes, one pair arising near middle of shaft. (Pl. LXXXI, fig. 3) ..... *athene* p. 1166
Aedeagus with only one pair of shaft processes 21
21. Aedeagal shaft processes arising at or before middle of shaft, shaft greatly reduced beyond processes 22
Aedeagal shaft processes apical 24
22. Aedeagal shaft processes arising before middle of shaft, pygofer with ventral angle evenly rounded, not produced. (Pl. LXXXV, fig. 2) ..... *cassiopeia* p. 1181
Aedeagal shaft processes arising at middle of shaft; pygofer with ventral posterior angle produced laterad or ventrad as a short process 23
23. Aedeagal shaft processes closely appressed to apical portion of shaft, basal half of shaft stout, broad in lateral aspect. (Pl. LXXXVI, fig. 4) ..... *niobe* p. 1183
Aedeagal shaft processes distinctly separated from shaft, from base; basal half of shaft slender, slightly wider than processes in lateral aspect. (Pl. LXXXVI, fig. 1) ..... *sollisa* p. 1182
24. Apical processes of aedeagus broadened in middle, half as long as shaft; pygofer without a lobe at dorsal angle. (Pl. LXXXVI, fig. 3) ..... *persephone* p. 1184
Apical processes of aedeagus short, less than one fourth length of shaft, appearing as a continuation of shaft 25
25. Apical processes of aedeagus nearly straight, shaft broadly inflated on distal half in caudal aspect; pygofer without lobe on dorsal angle. (Pl. LXXXVII, fig. 1) ..... *inflata* p. 1186
Apical processes of aedeagus sinuate, shaft of uniform width throughout in caudal aspect; pygofer with a lobe on dorsal angle. (Pl. LXXXVI, fig. 2) ..... *tortosa* p. 1185

Typhlocyba quercus (Fabricius)

(Pl. LXXXI, fig. 1)

Cicada quercus Fabricius, Genera Insectorum, Rhyngota, 1777, p. 298.
Tettigonia quercus, Germar, Magazin der Entomologie, vol. 4, 1821, p. 73.
Typhlocyba quercus, Herrich-Schäffer, Deutschlands Insecten, vol. 124, 1834, pp. 1-15.
Typhlocyba fasciata Tollen, Stett, Ent. Zeit., vol. 12, 1851, p. 73.
Anomia quercus, Fieber, Katalogue der Europaischen Cicadinen, 1872, p. 15.

This species is easily distinguished from other species in the

genus by having the apex of the plate laterally produced as an acute beaklike process, and by having fore wing with five orange-red spots forming a rough W.

Length.—3.0-3.5 mm.

Color.—Head, with dorsum bearing an orange-red, inverted V-shaped mark extending from margins of eyes to near middle of disc; pronotum, with an orange-red band along anterior margin, a large round orange spot on disc, remaining portions milky-white to light yellow; scutellum, with lateral angles orange-red, median band white to yellow; fore wing, with ground color white, with three evenly spaced red to orange-red spots on clavus along commissural margin, and two spots of the same color on inner two basal cells forming a rough W, connected to costal margin by two oblique brown lines; apical and cross veins white, apical and basal cells with light brown areas bordering cross veins; abdomen, dorsum black with outer margins of segments yellow, venter yellow, basal segments darker on basal half; pygofer, dorsum black, venter yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin continuous with ventral margin, evenly rounded to dorsal angle which is produced dorsad as a heavily-sclerotized, darkly-pigmented, sharply pointed hook, without macrosetae dorsad of outer basal angle of plate; plate, in ventral aspect, gradually reduced toward apex, produced laterad as a short, heavily sclerotized, beak-like process, in lateral aspect slightly curving dorsad, with one or two macrosetae near outer basal angle, a number of scattered microsetae in a submarginal row along lateral margin, a small group of macrosetae at apex. (Pl. LXXXI, fig. 1a).

Internal male genitalia.—Style with apical portion reduced, nearly equal in length to basal apodeme, a row of setae on outer margin and several alveoli on inner margin near apex; connective, almost quadrate; aedeagus, with atrial processes elongate, slender, gradually curving laterocephalad, length nearly equal to that of shaft; aedeagal shaft without apical processes, width nearly uniform from base to apex, slightly curving dorsad, anterior margin recurved at apex, with lightly sclerotized areas on sides near apex; aedeagal apodeme as wide as, but less than half as long as shaft in lateral aspect.

Female.—With posterior margin of eighth abdominal sternite nearly transverse, slightly sinuate, lateral fourth sharply directed cephalad (Pl. LXXXVII, figs. 8a, b).

A series of twenty-seven specimens collected from cultivated

cherry, in Vancouver, British Columbia, by Dr. H. H. Ross, July 15, 1948, and August 4, 1950, are the only North American specimens seen by the author. European specimens seen are: a pair from Poland, determined by J. Nast, 1937; one male from Sweden, labeled "Prunus", determined by F. Ossiannilsson, 1948; and three specimens in the U. S. National Museum Collection, bearing only the number 191.

Typhlocyba oneka Knull

(Pl. LXXXI, fig. 2)

Typhlocyba oneka Knull, Ohio J. Sci., vol. 44, no. 6, 1944, p. 270.

Resembling *T. tortosa* and *T. inflata* in having an apical pair of shaft processes, but differing in having a pair of slender atrial processes.

Length.—3.5 mm.

Color.—"Pale yellowish white, elytra semihyaline, below cream-colored, eyes pale", [from original description].

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly convex, dorsal angle produced dorsad as a broad apically rounded projection, ventral angle slightly produced ventrocaudad as a small lobe, a few macrosetae dorsad of outer basal angle of male plate, a large group of macrosetae along middle of posterior margin extending inward toward disc, posterior margin deeply inrolled; plate with apex spatulate.

Internal male genitalia.—Style elongate, slender, gradually tapering to acute apex, curving ventrolaterad, with a large patch of setae of ventral surface near middle extending from mesal to lateral margins, several alveoli on mesal margin near middle; connective, Y-shaped, with posterior margin produced medially; aedeagus, with atrial processes setaeform, two thirds length of shaft, slightly diverging apically; aedeagal shaft elongate, slender, with apical processes broadly attached at base, sharply reduced to acute laterally directed apices; aedeagal apodeme as broad as base of aedeagal shaft, strongly curving dorsocephalad.

Only the dissected abdomen of one male specimen has been seen by the author. The reported host for this species is *Corylus.* The known distribution for this species: *Minnesota:* Itasca County, July 27; *New York:* Cranberry Lake, July 15.

Types.—Holotype male, allotype, and paratypes, in the Herbert Osborn Collection of Ohio State University.

Typhlocyba athene McAtee

(Pl. LXXXI, fig. 3)

Typhlocyba athene McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 31.

Resembling *Typhlocyba niobe* and *T. persephone* externally, but differing in having the dorsal angle of pygofer produced as a slender acute hook, and by having a pair of atrial processes which are fused to shaft to middle, and a pair of apical processes.

Length.—3.0-3.5 mm.

Color.—Head, pronotum, and scutellum pale to deep yellow; fore wings deep yellow; abdomen yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly convex, dorsal angle produced as a sharp, elongate, ventrocaudally directed hook, ventral angle produced as a short acute hook directed ventrad, one or a few macrosetae dorsad of outer basal angle of male plate, a large group of macrosetae dorsad of outer basal angle of male plate, a large group of macrosetae on middle of posterior margin extending inward toward disc; male plate with apex spatulate.

Internal male genitalia.—Styles and connective like those of *Typhlocyba oneka* (Pl. LXXXI, fig. 2d, e); aedeagus, with atrial processes fused to shaft to near middle, gradually tapering to acute, dorsolaterally directed apices; aedeagal shaft broad at base, slightly reduced toward apex, with a pair of laterally diverging apical processes; aedeagal apodeme broad as shaft, nearly vertical, with a short anteriorly directed arm at apex.

A series of twenty-eight male specimens has been collected from *Acer saccharum*, by the author, in Milwaukee, Wisconsin, taken in association with *T. niobe*, *T. persephone*, *Ossiannilssonola serrula*, and *Edwardsiana lethierryi*. It has not been possible to separate the female specimens from those of some of these species.

Specimens have been seen from the following localities: *New Hampshire:* Lee, July 7; *Connecticut:* New Haven, October 16; *Pennsylvania:* Northeast; Kane; *Illinois:* Urbana, June 7; *Wisconsin:* Milwaukee, June 27, 28, 30, July 1.

Types.—Holotype male, in the Illinois State Natural History Survey Collection.

Typhlocyba arsinoe McAtee

(Pl. LXXXI, fig. 4)

Typhlocyba arsinoe McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 31-32.

Resembling *T. pomaria* in external appearance, but differing in not having face of male orange-red, in having a pair of apical proc-

esses on shaft of aedeagus, and in having ventral angle forming a small apically rounded lobe.

Length.—3.25-3.5 mm.

Color.—Head, pronotum, and scutellum white to light yellow; fore wings white to deep orange-yellow; abdomen yellow; apex of ventral angle of pygofer black.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly concave, dorsal angle slightly produced, ventral angle strongly produced as a short, rounded ventrocaudally directed lobe which curves laterad, macrosetae near anterior margin of ventral lobe distant from outer basal angle of plate, microsetae posterior to these, a few scattered along posterior margin; male plate, with apex spatulate.

Internal male genitalia.—Styles and connective as in *T. oneka* (Pl. LXXXI, fig. 2d, e) but with fewer setae on style; aedeagus with atrial processes elongate, slender, gradually tapering to acute apices, nearly attaining apex of aedeagal shaft in length, closely appressed to ventral margin of shaft to middle its length, then diverging laterad; aedeagal shaft slightly laterally compressed, a single pair of apical processes arising subapically on posterior margin and curving sharply laterodorsad; aedeagal apodeme directed dorsocaudad on basal two thirds, cephalad on apical third in lateral aspect.

Specimens have been seen from the following localities: *Ontario:* Vineland Station, June 22; *New Hampshire:* Durham, August 30; *Michigan:* Lake Gogebic, August 18; *Wisconsin:* Milwaukee, June 27, July 3, 5; Amery, August 13; *Illinois:* Muncie, July 23; Oakwood, June 14; *Massachusetts:* Boston, August 31.

The host species is *Tilea americana.*

Types.—Holotype male and allotype female, in the U. S. National Museum Collection.

Typhlocyba modesta Gibson

(Pl. LXXXII, fig. 1)

Typhlocyba modesta Gibson, Canadian Ent., vol. 49, no. 5, 1917, p. 184.

Resembling *Edwardsiana candidula* in outward appearance, and *T. hockingensis* in shape of aedeagus, but distinguished from these and other species by having aedeagus with atrial processes fused medially on basal fourth or half, and by having on dorsal angle of pygofer a short, thornlike, dorsally directed hook.

Color.—Dorsum uniform ivory white to pale yellow; fore wings subhyaline to cross veins, apical cells hyaline and slightly fumose; abdomen ivory white.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin produced on dorsal half as a broad arm, bearing a short, acute, dorsally directed hook and a small ventral lobe, ventral angle a smoothly rounded lobe, a group of short macrosetae just dorsad of outer basal angle of male plate, and a patch of macrosetae on dorsal arm near margin; male plate with apex spatulate.

Internal male genitalia.—Style with lateral margin bearing a short thumblike lobe covered with setae, inner and outer margins with a row of microsetae, several alveoli on inner margin near outer third; connective broadly attached to base of aedeagus; aedeagus with atrial processes fused to each other on basal fourth or half, continuing dorsad nearly parallel to each other, slightly diverging laterad at apex, elongate, slender, scarcely tapering until shortly before apex; aedeagal shaft greatly elevated above atrial processes, arising from anterior margin of base of aedeagus near dorsal extremity; base of aedeagus broadened laterally near apex; aedeagal apodeme having both anterior and posterior arms.

Female.—With posterior margin of eighth abdominal sternite having a distinct median notch between two smoothly rounded lobes (Pl. LXXXVII, fig. 11).

A large series has been taken by the author in Douglas County, Kansas, and a short series in Milwaukee, Wisconsin, on *Acer saccharinum.* Specimens have been seen from the following localities: *New York:* Minetto, August 15; *Virginia:* Mountain Lake, July 11, 12, 15, 18, 23; Falls Church, May 30, August 4, 11; *Massachusetts:* Holiston, July; *Kentucky:* Louisville, July 27; Kentucky Ridge State Forest, June 11; *North Carolina:* Brevard, June 20; *South Carolina:* Clemson College; *Georgia:* Pemiscot County, September 26; *Ohio:* Wooster, July 8; Barberton, August 11; *Indiana:* Kosciusko County, July 8; Lafayette, August 21, 30; *Illinois:* Decatur, August; Urbana, July 13; *Wisconsin:* Milwaukee, June 27-July 5; *Minnesota:* St. Paul, June 17, August 17; *Iowa:* Ames, June 8, 19, September 6; Davenport, September 8; Muscatine, June 6, 8, 9, August 22; County #88, September 23, August 1; *Missouri:* Charleston, June 7; *Kansas:* Manhattan, June 8, 14; Douglas County, May 29 to August 14; *Colorado:* Ft. Collins, June 24, July 3, 14.

Types.—Holotype, allotype, and female paratype, in U. S. National Museum Collection, have been seen.

Typhlocyba medleri sp. nov.

(Pl. LXXXII, fig. 2)

Resembling *T. surcula* in external appearance, but distinguished from this species by not having pygofer hook on dorsal angle, and having aedeagal shaft a slender cylindrical tube of nearly uniform diameter.

Length.—3.5-3.75 mm.

Color.—Dorsum milky-white to cross veins, subhyaline, apical cells entirely fumose, hyaline; abdomen milky-white, apex of male plate black.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight, slanting obliquely ventrocaudad on dorsal half, dorsal angle not produced, forming an apically rounded right angle; ventral angle reduced to a small, rounded, ventrally directed lobe arising near middle of posterior margin of pygofer, ventral half of posterior margin forming an evenly rounded ventral lobe, a group of macrosetae just dorsad of outer basal angle of male plate, a row of macrosetae along dorsal half of posterior margin; male plate with apex spatulate.

Internal male genitalia.—Connective broadly attached to aedeagus; aedeagus with atrial processes elongate, slender, diverging from each other from base, strongly curving dorsad; base of aedeagus forming a U-shaped, posteriorly opened plate with atrial processes broadly attached to arms; aedeagal shaft slender, elongate, arising from between arms of base, nearly uniform in diameter throughout its length; aedeagal apodeme short, apically enlarged.

Types.—Holotype male, allotype female, paratype male, and four paratype females, Milwaukee, Wisconsin, June 26, 1950; two female paratypes, Milwaukee, Wisconsin, June 29, 1950, P. J. Christian, in the Snow Entomological Collections of the University of Kansas.

Typhlocyba hockingensis Knull

(Pl. LXXXII, fig. 3)

Typhlocyba hockingensis Knull, Ohio J. Sci., vol. 44, no. 6, 1944, p. 270.

Resembling *T. pomaria* and *T. modesta,* but differing from these by having the dorsal angle of pygofer without hooks, and forming a right angle; aedeagus with atrial processes distant from aedeagal shaft, asymmetrical, the left process curving cephalad and crossing over right process.

Length.—3.25-3.5 mm.

Color.—Dorsum pale yellowish-white to light yellow; fore wings

subhyaline to cross veins, apical cells faintly fumose, hyaline; abdomen light yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly convex, dorsal angle slightly rounded forming nearly a right angle, ventral angle produced ventrad in a long sharp hook, a small group of macrosetae just posterior to lateral basal angle of male plate, a few macrosetae on ventral half of posterior margin; male plate with apex spatulate.

Internal male genitalia.—Aedeagus with atrial processes elongate, slender, as broad as shaft in lateral aspect, asymmetrical, left process crossing over right anteriorly near middle; shaft arising from dorsal anterior margin of base, parallel to and half the length of atrial processes; aedeagal apodeme reduced or absent.

A large series of this species was collected in Milwaukee, Wisconsin, from a species of *Viburnum* used as an ornamental shrub in the city parks. Serious injury was noted in some areas while in other areas injury was only slight. A short series was collected from blackberry bushes, Goodman, Missouri, and another short series from *Ulmus fulva*, in Douglas County, Kansas. Specimens have been seen from the following localities: *Alaska:* Ft. Yukon, July 15; *British Columbia:* Hope, August 1; *Ontario:* Vineland Station, July 1; Beamsville, June 20; *New Hampshire:* Alton, October 2; Jackson, September 18; Durham, July 8, 14; *Maryland:* Ashton, September 5; *Pennsylvania:* Hartstown Bog, September 14; *Virginia:* Mountain Lake, September 2; *Kentucky:* Louisville, June 7, July 28; *Tennessee:* Great Smoky Mountains National Park, September 1; *Ohio:* Shawnee Forest, June 9; *Minnesota:* St. Paul, June 16; Marshall County, June 24; *Wisconsin:* Lake Geneva, September 1; Milwaukee, June 26-July 5; *Missouri:* Goodman, May 28; *Kansas:* Douglas County, May 28, 30, June 9-30, July 1, September 24.

Types.—Holotype male, allotype female, and paratypes, in the Collection of Mrs. J. N. Knull, Columbus, Ohio; paratypes in the Ohio State University Collection, in the Canadian National Collection, and in the Snow Entomological Collections of the University of Kansas.

Typhlocyba pomaria McAtee

(Pl. LXXXII, fig. 4)

Typhlocyba pomaria McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 29-31.
Empoa pomaria, Stear, Pennsylvania Acad. Sci., vol. 2, 1928, pp. 54-58.

Resembling *T. hockingensis* in shape of pygofer, but distinguished by having aedeagal shaft arising from between atrial processes;

pygofer with dorsal angle reduced and not forming a right angle; face of male usually red-orange.

Length.—3.25-3.5 mm.

Color.—Dorsum light yellowish-white to yellow; fore wings subhyaline to cross veins, apical cells hyaline, fumose; abdomen light yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight, obliquely slanting posteriorly, dorsal angle broadly rounded, ventral angle produced ventral in a long sharp hook as in *T. hockingensis*, a group of macrosetae just dorsad of outer basal angle of plate, a patch of macrosetae on posterior margin near middle; male plate with apical lobe rounded, only slightly enlarged.

Internal male genitalia.—Aedeagus with atrial processes elongate, broadly attached at base, tapering to acute sinuate apices; aedeagal shaft arising from between atrial processes, broadened laterally and apically as a thin plate, gonopore subapical on ventrocaudal surface; base of aedeagus and apodeme reduced.

Female.—With posterior margin of eighth abdominal sternite sinuate, slightly produced medially, with lateral third curving strongly dorsocephalad (Pl. LXXXVII, figs. 12a, b).

This species occurs on species of *Malus* and on *Ulmus americana*. The approved common name for this species is "The White Apple Leafhopper" (Muesbeck, 1950, p. 138) and is referred to by this name in the numerous papers concerning its biology and control which have been published since its description. It probably occurs in all of the regions of North America where its host plants are found. Specimens have been seen from the following localities: *Alaska:* Fairbanks, July 30; Matanuska, July 21; Ft. Yukon, July 15; *British Columbia:* Vancouver, August 5, 8; *Quebec:* Newaygo, July 30; *Nova Scotia:* Smith's Cove, October 4; King's County; *Ontario:* Vineland Station, August 17, 29, September 9, 14, October 10; Simcoe, October 6; Trenton, June 17; Chelsea, June 20-25; Ottawa, June 18, August 22, October 1; Fenwick, October 10; St. David's, June 26; *Massachusetts:* Greenfield, August 24; Holliston, July, September 16-22; *New Hampshire:* Wilton County, September 30; Durham, September 13, August 21, 27; *Vermont:* Mount Mansfield, July 26; *New York:* Ithaca, June 8, 12, 17; *Pennsylvania:* Procter, July 21; Hartstown Bog, June 26, September 13; Northeast, June 15, July 2, 3; Westchester, July 6; *Maryland:* Lakeland, September 12; *Virginia:* Arlington, May 30, June 11, 15, September 19, 29; Leesburg, August 17, September; Copeley, October 6; *Kentucky:* Louisville, October

12; *Tennessee:* Gatlinburg, June 14; Great Smoky Mountains National Park, September 1; *Indiana:* Noble County; *Illinois:* Cook County, June 22; Thornton, September 7; R. Canyon State Park, July 10; Olney, September 21; *Minnesota:* St. Paul, August 25; Winona County, July 1; Itaska County, August 19; *Michigan:* August 18; *South Dakota:* Brookings, June 7, 8, 25, July 1; *Wisconsin:* Milwaukee, June 26-July 7; Brule, August 19; Rib Mountain State Park, August 27; Madison, June 24; Cramoor, August 11; Lake Geneva, June 16-24, July 4, 9, 12; *Iowa:* Ames, September 3 through 22; Davenport, June 10, September 3; Muscatine, June 4-15; *Missouri:* Oregon County, May 28; *Kansas:* Douglas County, May 27-June 24, September 20-21; Riley County, September 21; *Arkansas:* Bentonville, September 1; *Colorado:* Glen Haven, August 1; Ft. Collins, June 14, 20, July 3, September 4, 10, 23; *Utah:* Providence, October 8; Richfield, June 15, August 7; Logan, June 2-27, September 14, 22; Provo, September 17; Lake View, July 17; *New Mexico:* Espanola, June 18; *Idaho:* Twin Falls, June 14; Moscow, June 19; Parma, July 25, September 22; Idaho Falls, July 27; River Dale, August 12, September 1; *Washington:* Dishman, July 7; *Oregon:* Salem, October 22; Hood River, July 17, August 20; Yoncalla, July 12; The Dalles, June 8, 10, 18; Azales, September, October; Peoria, October; Lancaster, October; Umatilla, October; Junction City, October; Gold Hill, October; 5 miles north of Coberg, October; Durfur; Green Springs Mountain; Ashland; Jacksonville; Clackomas; *California:* Mount Shasta Canyon, June 29.

Types.—Holotype, allotype, and paratypes, in the U. S. National Museum Collection; paratypes, in the Snow Entomological Collections of the University of Kansas, in the Illinois State Natural History Survey Collection, and in the Iowa State College Collection. The male paratype from Cabin John Bridge, Maryland, June 17, 1915, Roberts, is a male of *Edwardsiana rosae.*

Typhlocyba attenuata sp. nov.

(Pl. LXXXIII, fig. 1)

Resembling *T. putmani, Edwardsiana dejecta,* and *Empoa albicans* in outward appearance, and *T. rubriocellata* in shape of aedeagus, distinguished from these species by having dorsal posterior angle of pygofer produced in an acute, lightly sclerotized, attenuate hook.

Length.—4.0-4.25 mm.

Color.—Dorsum pale white to yellow; fore wings subhyaline to

cross veins, apex hyaline, not fumose; abdomen yellow, ventral angle of pygofer black on apex.

Genital capsule.—Male pygofer, in lateral aspect, with dorsal angle produced posteriorly in an attenuate hook, ventral angle acute, produced ventrad as a small, apically rounded tubercle, a group of macrosetae just posterior to outer basal angle of plate, a large patch of short macrosetae along middle of posterior margin extending inward submarginally on disc; male plate with apex rounded, not spatulate.

Internal male genitalia.—Style broad, elongate, slightly enlarged subapically, with setae on outer margin extending nearly to apex, several alveoli on mesal margin near middle, scattered setae basad of these; connective broadly triangular; aedeagus with atrial processes elongate, slender, nearly straight, as long as shaft, fused shortly before base, diverging laterad to dorsally curved apices, a small ventral process at base; aedeagal shaft arising from anterior margin of dorsal half of base of aedeagus, expanded laterally and apically as a thin, lightly sclerotized plate, medially more heavily sclerotized, apical third slightly broader and distally rounded, gonoduct opening subapically on ventrocaudal surface; base of aedeagus forming a broad pillar supporting and elevating shaft above atrial processes.

Female.—With posterior margin of eighth abdominal sternite broadly evenly rounded, not produced or incised (Pl. LXXXVII, fig. 9).

A large number of specimens of this species have been collected on *Aesculus glabra* var. *sargentii* in Douglas County, Kansas.

Types.—Holotype male, allotype female, and numerous paratypes of both sexes, Douglas County, Kansas, May 28, 1949, R. H. Beamer; additional paratypes: one male, Rosedale, Kansas, June 23, 1924, E. P. Breaky; six females, Atchison County, Kansas, July 10-16, E. P. Breaky and R. H. Beamer; six females, Douglas County, Kansas, June 25, 1945, R. H. Beamer; ninety-nine males and females, Douglas County, Kansas, May 27, 1949, R. H. Beamer and P. J. Christian; sixty-seven males and females, Douglas County, Kansas, May 29-31, 1949, R. H. Beamer and P. J. Christian; two females, June 18, 22, 1949, Douglas County, Kansas, P. J. Christian; three females, May 29, 1950, ten females, June 3, 1950, one male and four females, June 5, 1950, one male and two females, June 7, 1950, two males and two females, June 8, 1950, Douglas County, Kansas, P. J. Christian. Types in the Snow Entomological Collections of the University of Kansas.

Typhlocyba rubriocellata Malloch

(Pl. LXXXIII, fig. 2)

Typhlocyba rubriocellata Malloch, Bull. Brooklyn Ent. Soc., vol. 15, nos. 2 and 3, 1920, p. 48.
Typhlocyba rubriocellata var. *clara* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 21.
Typhlocyba escana Ross and DeLong, Ohio J. Sci., vol. 49, no. 3, 1949, pp. 117-118. (*new synonymy*)

Resembling *T. attenuata* in shape of aedeagus, but easily distinguished by having a broad brown band across apical veins, and usually with a bright crimson-red spot on fore wing.

Length.—3.5-4.0 mm.

Color.—Dorsum with ground color yellowish-white; fore wings with a solid dark brown band over cross veins covering ends of cells bordering on cross veins, with bright crimson-red spot of variable size in middle of each fore wing along middle of inner half of clavus and over part of basal half of inner two basal cells, entirely absent in some specimens, fore wings subhyaline to cross veins, hyaline beyond dark band, slightly fumose; abdomen yellowish-white.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin strongly convex, dorsal posterior margin directed dorsad, ventral angle forming a broadly rounded lobe interrupted by a slight ventral hook, posterior margin deeply inrolled; male plate with apex rounded but not spatulate.

Internal male genitalia.—Style, connective, and aedeagus very similar to those of the preceding species; aedeagus with atrial processes shorter than shaft, elongate, slender; aedeagal shaft arising from dorsal two thirds of base, broadly expanded, not constricted subapically, more broadly expanded laterally; base of aedeagus broadened laterally, a short anteriorly directed apodeme on anterior margin at apex.

Female.—With posterior margin of eighth abdominal sternite broadly evenly rounded, as in *T. attenuata* (Pl. LXXXVII, fig. 9).

A large series of specimens has been seen from the type locality, collected on *Aesculus* sp. Specimens have been seen from the following localities: *Illinois:* Urbana, July 12, 14, 20; *Ohio:* Columbus, June 1; *New York:* Monroe, July 10; *Kentucky:* Kentucky Ridge State Forest, June 11; *Tennessee:* Gatlinburg, June 24, 28, July 12, 20, 21; Great Smoky Mountains, June 18, September 1.

Types.—Holotype female, in the Illinois State Natural History Survey Collection; a male from Urbana, Illinois, July 14, 1946, R. H.

Beamer, here designated *neoallotype,* in the Snow Entomological Collections of the University of Kansas; one *paraallotype* male, Great Smoky Mountains, Tennessee, June 18, 1939, C. P. Alexander, in the U. S. National Museum Collection.

Typhlocyba surcula DeLong and Johnson

(Pl. LXXXIII, fig. 3)

Typhlocyba surcula DeLong and Johnson, Ent. News, vol. 47, no. 4, 1936, p. 103.

Resembling *T. medleri* externally, but with an acute pygofer hook directed posteriorly from dorsal angle.

Length.—3.25 mm.

Color.—Dorsum pale yellowish-white; fore wings subhyaline to cross veins, apical cells hyaline, faintly fumose; abdomen yellowish-white.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly convex ventrad of dorsal processes, dorsal process broad basally but reduced strongly to an acute, heavily sclerotized, posteriorly directed apex, ventral angle forming a small round ventrally directed lobe; male plate with apex not spatulate.

Internal male genitalia.—Style produced laterad in a broad, angular projection near point of attachment to connective, apex strongly curving ventrolaterad, setae scattered over ventral surface from lateral to mesal margins at middle, a few setae on lateral margin extending more distad, several alveoli on mesal margin at outer third; connective with anterior median lobe strongly produced; aedeagus, similar to preceding species but with atrial processes slender from base, shaft arising slightly above bases of processes; apex transparent, acutely pointed, sclerotized portions making it appear bifurcate; aedeagal apodeme V-shaped in dorsal aspect, arising from lateral arms of base.

One specimen of this species was taken on *Quercus muhlenbergii* in Douglas County, Kansas, and other specimens have been collected in Milwaukee, Wisconsin, from mixed trees and bushes not including the above species.

Specimens have been seen from the following localities: *Minnesota:* St. Paul, June 27; *Wisconsin:* Milwaukee, June 29, July 2, 7; Wisconsin Rapids, July 27; Cranmoor, July 27; *Illinois; Kansas:* Douglas County, June 11.

Types.—Holotype and paratype males, in the collection of D. M. DeLong, Columbus, Ohio.

Typhlocyba andromache McAtee

(Pl. LXXXIII, fig. 4)

Typhlocyba andromache McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 32.

Resembling *T. surcula* in external appearance and in shape of aedeagus, but easily distinguished by lacking dorsal hook on pygofer, and by having posterior margin nearly straight.

Length.—3.0-3.25 mm.

Color.—Dorsum pale yellowish-white; fore wings subhyaline to cross veins, apical cells hyaline, slightly fumose.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight, dorsal angle acute, slightly less than a right angle, ventral angle slightly more than a right angle and forming a small ventrally directed hook; male plate with apex only slightly enlarged.

Internal male genitalia.—Aedeagus with atrial processes broad, elongate, exceeding shaft in length, diverging laterodorsad from base, slightly sinuate, reduced to acute apices on outer fourth; aedeagal shaft arising from base slightly above bases of processes, laterally broadened, margins foliaceous, broadest at gonopore, nearly transparent and extending beyond gonopore as a thin plate with apex acute; base of aedeagus reduced, aedeagal apodeme directed dorsad and cephalad.

The following specimens have been seen: six males, Itasca County, Minnesota, July 26, 1939, J. T. Medler, and the holotype male, Salem, New York, June 27, 1924, on birch, E. D. Ball.

Typhlocyba melite McAtee

(Pl. LXXXIV, fig. 1)

Typhlocyba melite McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 32.

Resembling *T. arsinoe* in external appearance, but differing in having atrial processes of aedeagus greatly broadened on basal two thirds, and with a short hook at middle of posterior margin of pygofer.

Length.—3.5-3.75 mm.

Color.—Dorsum pale yellowish-white to yellow; fore wings subhyaline to cross veins, apical cells hyaline, not fumose; abdomen yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly convex, dorsal angle reduced, dorsal and posterior margins almost continuous, a small ventrocaudally directed hook

near middle of posterior margin, ventrocaudal margin broadly rounded ventrad of hook; male plate with apex spatulate.

Internal male genitalia.—Connective Y-shaped with anterior and posterior medial lobes narrowed; aedeagus with atrial processes broadly flattened on basal two thirds, slightly narrowed before base, outer third gradually tapering to acute apex; aedeagal shaft arising from ventrad of processes and between them, slender, laterally flattened, elongate, gradually tapering to apex, strongly recurved just before apex and appearing bifid due to differential sclerotization, posterior margin strongly convex; aedeagal apodeme short, sharply curving ventrocephalad.

A large series of specimens has been collected by the author from gooseberry (*Ribes* sp.) in Milwaukee, Wisconsin, and another series from pawpaw (*Asimina triloba*) in Douglas County, Kansas. Specimens have been seen from the following localities: *Ontario:* Vineland Station, June 30, July 4, 8; *Massachusetts:* Boston, July 27; *New York:* Sea Cliff, August; Hudson Valley, June 14; *Kentucky:* Kentucky Ridge State Forest, June 11; *Ohio:* Columbus, June 15; *Minnesota:* St. Paul, June 15, 16, 19; Ramsay County, May 30; *Wisconsin:* Milwaukee, June 27-July 4; *Illinois:* Western Springs, June 21; *Iowa:* Ames, May 25; *Missouri:* Kansas City, May 29; *Kansas:* Douglas County, June 2-July 5, September; *Colorado; Washington:* Kalama, July 4.

Types.—Holotype male, and paratype, in U. S. National Museum; allotype and paratypes of both sexes in the Museum of Comparative Zoology.

Typhlocyba alabamaensis sp. nov.

(Pl. LXXXIV, fig. 2)

Resembling *T. medleri* externally, but with dark apical markings more intense along cross veins, aedeagus differs from those of other species in having ventrocaudal margin concave rather than convex.

Length.—3.5 mm.

Color.—Dorsum light yellow to cross veins; fore wings subhyaline to cross veins, apical cells dark brown, hyaline, more intensely colored along cross veins.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin sinuate, dorsal angle produced in a broad, laterally concave, dorsocaudally directed, apically rounded process, ventral angle directed ventrocaudad as a broad apically rounded lobe arising from mesad of ventral lobe, a group of macrosetae just dorsad of outer basal angle of male plate extending to middle of disc, scattered

microsetae posterior to these and along dorsal margin near base of anal tube; male plate with apical lobe scarcely enlarged.

Internal male genitalia.—Connective with a transverse bar at apex of anterior lobe, appearing T-shaped as in *T. crassa;* aedeagus with atrial processes broad, elongate, diverging laterally from base, curved sharply mesad near apex, curving dorsocaudad in lateral aspect, gradually reduced to acute apex; aedeagal shaft arising from between processes, half as long as atrial processes, broadly attached to base in lateral aspect, laterally compressed, posterior margin forming a sharp ventrally concave keel gradually diminished toward apex; base of aedeagus shield shaped in posterior aspect, with aedeagal apodeme V-shaped and attached to divergent arms of base.

Types.—Holotype male and male paratype, La Place, Alabama, near Tuskeege, June 9, 1917, in the Cornell University Collection.

Typhlocyba shawneeana Knull

(Pl. LXXXIV, fig. 3)

Typhlocyba shawneeana Knull, Ohio J. Sci., vol. 44, no. 6, 1944, p. 270.

Resembling *T. andromache* in external appearance and in shape of pygofer, but easily distinguished from that species by having two pairs of shaft processes.

Length.—3.5-4.0 mm.

Color.—Dorsum pale yellow; fore wings subhyaline to cross veins, apex hyaline.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight, almost vertical, dorsal and ventral angles sharp right angles, slightly produced, a few macrosetae just dorsad of outer basal angle of male plate, a group of macrosetae on dorsal half of posterior margin of pygofer extending slightly inward on disc; male plate with apex spatulate.

Internal male genitalia.—Aedeagus with atrial processes elongate, broad, enlarged at base, gradually reduced on outer third to acute apices, exceeding shaft in length; aedeagal shaft bearing two pairs of processes of about equal length, one pair at apex directed dorsocaudad, widely diverging, the other pair at outer fifth curving mesad caudally from lateral margins of shaft, shaft greatly broadened, margins foliacious, outer fifth reduced to half width at base, directed dorsad, slightly convex on basal half; aedeagal apodeme broad, directed cephalad.

This species has been collected by the author from witch hazel (*Hamamelis virginiana*) in Milwaukee, Wisconsin. Although not abundant, a number of specimens were collected by aspirator from

the under surfaces of those leaves which showed considerable feeding injury. Nymphs and freshly emerged males were found on the host.

Specimens have been seen from the following localities: *Ohio:* Fairfield, June 16; *Tennessee:* Great Smoky Mountain National Park, September 1, on witch hazel; *Wisconsin:* Milwaukee, July 5, 7.

Types.—Holotype and paratype males, in the collection of Mrs. J. N. Knull, Columbus, Ohio; a female collected by the author, July 7, 1950, Milwaukee, Wisconsin, here designated *neoallotype,* in the Snow Entomological Collections of the University of Kansas.

Typhlocyba transviridis sp. nov.

(Pl. LXXXIV, fig. 4)

Resembling *T. cassiopeia* in being light green when fresh and later changing to yellow; easily distinguished from other species by having a broad, brown, transverse band covering median third of fore wings.

Length.—3.25-3.5 mm.

Color.—Fresh specimens bright green with a broad greenish-brown transverse band on median third of fore wings, color later changing to yellow with a broad yellowish-brown band, veins across band sometimes light colored, apical cells light colored, hyaline; abdomen bright green changing to yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin continuous with dorsal margin, dorsal angle greatly reduced, ventral angle forming a broad caudally directed lobe with a small ventrally directed hook on ventral margin, a group of macrosetae just dorsad of outer basal angle of male plate, numerous microsetae scattered on ventral lobe over disc and along dorsal margin, a large group of macrosetae extending along most of the posterior margin and inward on disc; male plate not enlarged at apex.

Internal male genitalia.—Style with lateral margin bearing two lobes near middle, a few scattered setae on lateral and mesal margins; connective as in *T. cassiopeia* (Pl. LXXXV, fig. 2); aedeagus with atrial processes elongate, slender, gradually reduced to acute apices, slightly divergent on outer sixth to apex, strongly curving dorsocephalad from base, parallel to shaft; aedeagal shaft arising between processes and continuing between them throughout its length, two thirds as long as processes and of equal width; base of aedeagus a broad dorsal arm bearing a short anteriorly directed apodeme at apex.

A large series of specimens of this species has been collected by the author from *Tilea americana* (linden) in Milwaukee, Wisconsin.

Types.—Holotype, allotype, six male and fourteen female paratypes, July 2, 1950, Milwaukee, Wisconsin, P. J. Christian; additional paratypes: one male, June 30, 1950; one female, July 1, 1950; three females, July 3, 1950; four males, July 4, 1950; eight males and four females, July 5, 1950; two females, July 7, 1950, Milwaukee, Wisconsin, P. J. Christian. Types in the Snow Entomological Collections of the University of Kansas.

Typhlocyba putmani Knull

(Pl. LXXXV, fig. 1)

Typhlocyba putmani Knull, Ohio J. Sci., vol. 44, no. 6, 1944, p. 269.

Resembling *T. attenuata, Empoa albicans,* and *Edwardsiana dejecta* in size and color; distinguished by having aedeagal shaft flattened laterally and lying ventrocaudad of atrial processes throughout its length.

Length.—4.0-4.25 mm.

Color.—Dorsum pale yellow without dark markings; fore wings subhyaline to cross veins, apical cells hyaline; abdomen pale yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly angular, dorsal angle reduced, ventral angle produced ventrad as a short acute tooth, a vertical row of macrosetae just dorsad of outer basal angle of male plate, a patch of macrosetae at middle of posterior margin; male plate with apex spatulate.

Internal male genitalia.—Style with a short hook on lateral margin near attachment to connective, a row of setae along lateral and mesal margins, several alveoli beyond these on mesal margin at outer third; connective triangular; aedeagus, with atrial processes broadly attached at base, compressed laterally, gradually tapering to acute recurved apices, exceeding shaft in length by outer third; aedeagal shaft elongate, slender, laterally flattened, gradually reduced to outer fourth, more abruptly reduced to apex, arising ventrad of processes and continuing posterior of them throughout its length; aedeagal apodeme similar to that of the preceding species.

A large series of this species has been collected by the author from *Cornus stolonifera,* Milwaukee, Wisconsin, in association with *Edwardsiana dejecta,* where noticeable injury could be seen on hedges of the host plants in the city parks. Specimens have been seen from the following localities: *New York:* Glen Cove, Long Island, July 8; *Virginia:* Mountain Lake, July 21; *West Virginia:*

Great Cacapon, July 4; *Tennessee:* Great Smoky Mountains National Park, September 1; *Wisconsin:* Milwaukee, July 1, 3, 4; *British Columbia:* Vancouver, August 4.

Types.—Holotype male, allotype, and paratypes, Vineland Station, Ontario, in the Canadian National Collection.

Typhlocyba cassiopeia Knull

(Pl. LXXXV, fig. 2)

Typhlocyba cassiopeia Knull, Ohio J. Sci., vol. 44, no. 6, 1944, p. 269.

Resembling *T. transviridis* in shape of aedeagus and pygofer, but lacking brown color markings; atrial processes fused to aedeagal shaft on basal third and closely appressed to shaft concealing it throughout most of its length.

Length.—3.25-3.5 mm.

Color.—Entire body light green when fresh, color changing to pale yellow, legs with apex of tibia remaining green longer than rest of body.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin evenly convex, dorsal angle reduced, dorsal and caudal margins nearly continuous, ventral angle forming an evenly rounded lobe; male plate not enlarged apically.

Internal male genitalia.—Aedeagus with atrial processes arising from basal third of shaft, slender, elongate, gradually reduced to acute apices, slightly divergent, directed dorsad, closely following shaft and exceeding it in length; shaft slender, sometimes difficult to see in less heavily sclerotized specimens; base of aedeagus short with apodeme reduced.

The green color of the legs is useful in separating freshly collected specimens of this species from those of other light colored species, but after a month or two this color distinction is lost.

A large series of this species has been collected by the author from *Prunus virginiana* (*P. serotina*), in Milwaukee, Wisconsin. Paratype males from Vineland Station, Ontario, have been seen. Specimens have been seen from the following localities: *Massachusetts:* Holliston, July; *Ontario:* Vineland Station, June 27, July 4; *Minnesota:* St. Paul, June 22, Itasca County, July 12; *Wisconsin:* Milwaukee, June 26-July 7; *Illinois:* Cook County, June 22; *Iowa:* Ames, June 17; *Kansas:* Douglas County, August 19, 24 (a paratype of *T. pomaria* McAtee); *Washington:* Mount Rainier, July 27; *Oregon:* Jacksonville.

Types.—Holotype male, allotype, and paratypes, in the collection of Mrs. J. N. Knull; paratypes, in the Canadian National Collection.

Typhlocyba crassa DeLong and Johnson

(Pl. LXXXV, fig. 3)

Typhlocyba crassa DeLong and Johnson, Ent. News, vol. 47, no. 4, 1936, pp. 102, 104.

Resembling *T. putmani* in external appearance and in structure of male genitalia, but with posterior margin of pygofer straight, aedeagal shaft slender and of uniform diameter throughout its length, and atrial processes curving ventrad at base forming a bow which projects between male plates.

Length.—3.5-3.75 mm.

Color.—Dorsum pale yellowish-white; fore wings subhyaline to cross veins, apical cells hyaline.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin straight, nearly vertical, dorsal margin convex, dorsal angle rounded, ventral angle produced in a broad, acutely angled, ventrally-directed lobe, several macrosetae dorsad of outer basal angle of male plate, a patch of macrosetae along dorsal half of posterior margin; male plate with apex spatulate.

Internal male genitalia.—Connective broadened anteriorly as a transverse plate (Pl. LXXXV, fig. 3e); aedeagus, with atrial processes usually attenuate, twice length of shaft, directed ventrad at base, curved dorsocaudad to outer third, then curved dorsocephalad diverging laterally on outer fourth, median third appearing broadened in lateral aspect; shaft slender, elongate, of nearly uniform diameter from base to outer sixth where it is abruptly reduced beyond gonopore to a very acute apex; aedeagal apodeme forming a massive anteriorly directed arm.

The recorded host for this species is *Prunus serotina.*

Specimens have been seen from the following localities: *Ontario:* Vineland Station, July 4; *Pennsylvania:* Hartstown Bog, June 16, September 30; *Wisconsin:* Milwaukee, July 7; *Colorado:* Glen Haven, August 1; *Wyoming:* Yellowstone Park, August 15.

Types.—Holotype male, allotype female, and three female paratypes, in the collection of Dr. D. M. DeLong, Columbus, Ohio.

Typhlocyba sollisa Ross and DeLong

(Pl. LXXXVI, fig. 1)

Typhlocyba sollisa Ross and DeLong, Ohio J. Sci., vol. 49, no. 3, 1949, pp. 116-117.

Resembling *T. niobe* and *T. persephone* externally, but distin-

guished from these species by the aedeagal shaft having processes subapical and distinctly separate from shaft from base.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum yellow; fore wings yellow-orange, subhyaline to cross veins, apex hyaline, veins red-orange.

Genital capsule.—Male pygofer, in lateral aspect, with dorsal angle produced in a slight hook, ventral angle produced latero-ventrad as a small tubercule, a single macroseta dorsad of outer basal angle of male plate, patch of macrosetae near middle of posterior margin; male plate, with apex spatulate.

Internal male genitalia.—Aedeagus with a pair of lateral processes arising near middle of shaft and continuing parallel to it to apex, then curving sharply laterad, broadly attached to shaft; aedeagal shaft greatly reduced distad of processes, slender, shorter than processes; base of aedeagus slender, directed dorsad, a short, broad, anteriorly directed apodeme at apex.

The only specimen known is the holotype, taken at Grand Tower, Illinois, May 30, 1935, by Ross and Mohr.

Type.—Holotype male, in Illinois State Natural History Survey Collection.

Typhlocyba niobe McAtee

(Pl. LXXXVI, fig. 4)

Typhlocyba niobe McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 20.

Resembling *T. persephone* and *T. sollisa* externally, but distinguished from these by having aedeagal shaft broad on basal half and greatly reduced beyond shaft processes, shaft processes closely appressed to shaft, ventral angle of pygofer with pronounced hook.

Length.—3.5 mm.

Color.—Dorsum light sulfur-yellow to deep yellow-orange; fore wing subhyaline to cross veins, apex hyaline; abdomen sulfur-yellow.

Genital capsule.—Male pygofer in lateral aspect, with posterior margin slightly convex, dorsal angle slightly pointed, ventral angle produced ventrocaudad as a broad hooked lobe.

Internal male genitalia.—Aedeagus without atrial processes, with a pair of lateral processes arising near middle of shaft broadly attached to shaft and gradually diminishing to acute apices; aedeagal shaft greatly reduced distad of processes, continuing parallel to these nearly to apex where they diverge laterodorsad, basal half broadened dorsoventrally; base of aedeagus directed dorsocaudad with a short anteriorly directed apodeme.

A large series of this species has been taken in Milwaukee, Wisconsin, by the author, on *Acer saccharum* and *Acer platanoides* in association with *T. persephone* and several similarly colored species. Specimens have been seen from the following localities: *Michigan:* Agricultural College, July 5; *Wisconsin:* Milwaukee, June 26-July 6; *Illinois:* Andres, June 17; *Iowa:* Ames, June 20, 23.

Types.—Holotype male and paratypes of both sexes, in the U. S. National Museum Collection; allotype female and one pair of paratypes, in the Iowa State College Collection.

Typhlocyba persephone McAtee

(Pl. LXXXVI, fig. 3)

Typhlocyba persephone McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 11.
Typhlocyba lancifer McAtee, *op. cit.*, pp. 19-20. (*new synonymy*).

Resembling *T. niobe* and *T. sollisa* in external appearance, but distinguished by having aedeagal shaft processes apical.

Length.—3.5 mm.

Color.—Dorsum light sulfur-yellow to deep orange-yellow, some specimens red-orange; abdomen sulfur-yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly convex, dorsal angle not produced but slightly angular, ventral angle produced as a broad lobe slightly hooked at apex, a few macrosetae dorsad of outer basal angle of male plate, a row of macrosetae along dorsal three fourths of posterior margin; male plate with apex spatulate.

Internal male genitalia.—Style with apical portion beyond alveoli strongly reduced, apex curving ventrad; connective strongly produced anteriorly in a slender, elongate, median lobe; aedeagus without atrial processes, with shaft slender, elongate, gradually tapering toward apex in lateral aspect, apical processes broadly inflated near middle, directed dorsolaterad forming a distinct angle with shaft; base of aedeagus broad, directed dorsocaudad, with aedeagal apodeme arising from anterior margin at apex and directed cephalad.

Female.—With posterior margin of eighth abdominal sternite strongly curving dorsocephalad from midline, slightly produced medially as a rounded lobe (Pl. LXXXVII, figs. 10a, b).

A large series of specimens of this species has been taken by Dr. R. H. Beamer and the author, on *Acer saccharum,* in Douglas County, Kansas, in an unmixed population. Another large series was taken by the author from *Acer saccharum* and *A. platinoides,* in Milwaukee, Wisconsin, in association with *Typhlocyba niobe* and several other similar species.

Specimens have been seen from the following localities: *Massachusetts:* Hampshire County, June; *New Hampshire:* Durham, July 5, September 7; *Vermont:* Mansfield, July 24; *Ontario:* Vineland Station, June 22; *New York:* Minetto, June 13; *Tennessee:* Gatlinburg, June 14; *Wisconsin:* Milwaukee, June 27-July 5; *Illinois:* Urbana, June 4; *Kansas:* Douglas County, May 26-June 24; *Iowa:* Ames, June 20.

This species was described from a male specimen with apical processes of the aedeagus broken off, but in all other respects like the holotype of *T. lancifer.* Since the description of *T. persephone* precedes that of *T. lancifer,* the latter is considered a synonym of the former.

Types.—Holotype male, allotype and paratype females, in the U. S. National Museum Collection; all paratype males of this species seen by the author are specimens of *T. niobe.* The allotype and female paratype specimens may also be this species, but at present the author has not been able to distinquish between females of these two species so that they are being regarded as specimens of *T. persephone* until a sufficiently reliable method is found for distinguishing between them.

Typhlocyba tortosa Ross and DeLong

(Pl. LXXXVI, fig. 2)

Typhlocyba tortosa Ross and DeLong, Ohio J. Sci., vol. 49, no. 3, 1949, pp 115-116.

Resembling *T. niobe* in external appearance, but distinguished by having pygofer with ventral angle smoothly rounded, and in having apical processes short and only slightly subapical.

Length.—3.0 mm.

Color.—Dorsum pale white to light yellow; abdomen yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin convex at middle, dorsal angle produced as a short, broad, ventrally hooked process, ventral angle broadly rounded, with macrosetae dorsad of outer basal angle of plate, a large group of macrosetae on posterior margin at middle extending inward on disc; male plates with apex spatulate.

Internal male genitalia.—Style broadly curved ventrolaterad, slender, elongate, with ventral surface covered with setae at middle from lateral to median margins, several alveoli on mesal margin; connective as in *T. persephone* (Pl. LXXXVI, fig. 3); aedeagus without atrial processes, shaft slender, elongate, gradually reduced toward apex, extending dorsad; apical processes short, parallel,

sinuate, continuing in same direction as shaft; base of aedeagus forming a broad, caudally concave plate, with apodeme directed cephalad from dorsal margin.

A large series of specimens of this species collected by Dr. R. H. Beamer and the author, from *Ostrya virginiana,* Douglas County, Kansas, May 30, June 1, 7, a shorter series from the same host, Milwaukee, Wisconsin, June 28, 29, July 2, 7, collected by the author, and a single male, Wonalancet, New Hampshire, July 1, have been seen.

Types.—Holotype male from Oakwood, Illinois, June 14, in the Illinois State Natural History Collection; a female specimen collected by the author in Douglas County, Kansas, June 7, 1950, in association with males of this species, here designated *neoallotype,* is in the Snow Entomological Collections of the University of Kansas.

Typhlocyba inflata sp. nov.

(Pl. LXXXVII, fig. 1)

Resembling *T. tortosa* in outward appearance and in form of male genitalia, but differing in having distal half of aedeagal shaft inflated laterally, and in lacking lobe on dorsal angle of pygofer.

Length.—3.25-3.5 mm.

Color.—Dorsum pale whitish-yellow to light yellow; abdomen light yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin convex on lower third; dorsal angle rounded apically, not forming a lobe; ventral angle broadly rounded, a short laterally-directed hook at apex, several short macrosetae dorsad of outer basal angle of plate, a large group of macrosetae on posterior margin at middle extending inward on disc; male plate with apex spatulate.

Internal male genitalia.—Style broadly curving ventrolaterad, slender, elongate, with ventral surface covered with setae at middle from lateral to median margins, several alveoli on mesal margin; connective broadly triangular, median anterior lobe strongly produced; aedeagus without atrial processes, shaft slender, elongate, broadly inflated on apical half in caudal aspect; apical processes short, parallel, appearing as a continuation of shaft in lateral aspect; base of aedeagus forming a laterally flattened dorsal arm, with apodeme at apex reduced.

Types.—Holotype male, allotype female, one male and two female paratypes, Shelton, Washington, July 24, 1949, R. H. Beamer

in the Snow Entomological Collections of the University of Kansas; one male paratype, Wanakena, New York, August 1, 1917, C. J. Drake, in the Collection of Dr. D. M. DeLong.

Genus Empoa Fitch

(Pl. LXXXVIII)

Empoa Fitch, Ann. Rpt. New York St. Cab. Nat. Hist., vol. 4, 1851, p. 63.

Type, *Empoa querci* Fitch, 1851, by subsequent designation of Van Duzee (Check List of the Hemiptera, 1916, p. 77).

Fore wings.—As in genus *Typhlocyba.*

Hind wings.—As in genus *Typhlocyba* (Pl. LXXXI, fig. 1f).

Genital capsule.—Male plate gradually curving dorsad apically, reduced near middle, gradually tapering to rounded apex, with one macroseta near outer basal angle, a submarginal row of microsetae parallel to lateral margin near middle and extending over apical half of length; pygofer in lateral aspect with dorsal margin nearly horizontal, dorsal angle prominent, apex rounded, ventral angle reduced, lacking group of macrosetae dorsad of outer basal angle of male plate, a few scattered microsetae on disc and a group of macrosetae on posterior margin.

Internal male genitalia.—Style elongate, slender, gradually reduced to an acute apex, curving lateroventrad apically, with numerous setae on ventral surface at basal third, a row of setae extending along lateral margin to middle, several alveoli on mesal margin near middle, apex attenuate beyond these; connective elongate, triangular in ventral aspect; aedeagus without atrial processes, aedeagal shaft with posterior margin strongly curving dorsad from base, with three platelike enlargements on anterior margin, with three pairs of apical processes; aedeagal apodeme a broad dorsally directed arm arising at base of aedeagal shaft.

Female.—With posterior margin of eighth abdominal sternite slightly sinuate, strongly resembling that found in *Typhlocyba pomaria* (Pl. LXXXVII, figs. 12a, b).

Head in dorsal aspect narrower than pronotum, longer medially than next the eye, anterior margin of crown broadly rounded, face with clypellus conspicuously gibbous; pronotum short and broad, lateral margins strongly divergent posteriorly; posterior margin smoothly, shallowly convex, pleural portion broader than ocellocular area.

All of the species of the genus have black or brown color markings ranging in extent from only three spots along the cross veins, to covering nearly the entire dorsum. The ground color is usually

white to light yellow, but may be bright orange-yellow or even light pink to rose. The dark color pattern is variable within a species, and sometimes two or three sharply distinct forms may occur in one population. Variability of coloration appears to be the result of the action of two factors or groups of factors, one causing the gradual increase in intensity of color observed in maturing adults, the other controlling the ultimate extent of color pattern, shade of color, and intensity of color.

As a result of the action of the first factor, specimens of *Empoa gillettei* and similarly marked species pass successively through several color stages in the process of maturing. Extremely teneral specimens show traces of spots in the apices of the inner three basal cells, and as the intensity of color increases, an apical band will gradually become evident. As the apical band deepens in intensity a pale transverse median band begins to appear and increases in intensity while the scutellum and dorsum of the abdomen begin to show signs of dark color. The color of the scutellum continues deepening until it becomes dark brown or black.

This same sequence is observed in the maturing of *Empoa casta* and similarly marked species but usually terminates at the point when only the apical and median bands have become dark. Specimens of *Empoa apicata* and similarly colored species have only the apical band dark so that this process of color change is less noticeable. Specimens of *Empoa vestita*, and darkly marked specimens of *venusta* and *scripta* show a tendency toward a more uniform development of color, the apical portion of the wings darkening slightly earlier than the rest of the wing. In *Empoa albicans* the dark color appears to become evident in the scutellum before it can be seen in the wings. Color in the wings first appears in the apex of the clavus and gradually spreads to include all of the clavus and adjacent areas of the inner two or three basal cells.

The second factor, one which influences the final extent of color pattern and intensity of color, appears to be responsible for the occurrence of polymorphic species such as *E. venusta*, *E. scripta*, *E. albicans*, and to a lesser degree *E. casta*, *E. aureotecta*, and *E. vestita*.

Because of the similarity of partly colored specimens of species of the Gillettei Group to more fully colored specimens of species of the Casta Group, and because of similarity of partly colored specimens of species of the Casta Group to specimens of species of the Apicata Group, species in one group may be confused with species of another group. In addition to intergroup similarity,

specimens of species within each group are frequently very similar to each other when not fully mature. Variability of color pattern within these closely similar species is such that it is impossible to be certain to which species these marginal specimens belong in the absence of reliable host records, although usually the majority of mature specimens are easily distinguishable.

Although it is sometimes difficult to separate some of these species on the basis of color alone, population behavior observed has been such as would be expected of distinct species. Each species studied in the field was found to be closely associated with a certain host and was usually found on this host even in widely separated localities. Host relationship studies were made on *E. vestita* showing that fourth and fifth instar nymphs when transferred from their preferred host, *Ulmus fulva,* and restricted to either *U. pumila* or *U. americana* were able to develop normally. Under natural conditions where branches of *U. fulva* and *U. americana* were found interlaced, the nymphs showed exclusive preference for *U. fulva.* The nymphs of *E. vestita* were easily distinguished from those of *E. elmata,* which usually occurs on *U. americana,* because they are olive-green to greenish-brown in color and prefer to feed on the upper surfaces of the leaves, while nymphs of *E. elmata* and other species in the genus are white and prefer to feed on the lower surfaces of the leaves.

Population size was found to vary greatly for species on different hosts within the same area and under the same climatic conditions. Collections of a number of species on the University of Kansas campus in 1949 showed that populations of *E. vestita* and *E. casta* were very large, populations of *E. acericola, E. apicata, E. caryata,* and *E. elmata* to be small, and the population of *E. querci* very small, while no specimens of *E. venusta* could be found although collections were made on its host.

Changes in the size of population from 1949 to 1950 were found to differ for some of the species studied, while other species populations appeared to remain constant. Only a slight decrease in population was noted for *E. vestita,* while *E. casta* showed a very marked decrease in the size of its population. The populations of *E. acericola, E. caryata, E. elmata, E. apicata,* and *E. querci* did not show any marked degree of change in population.

Population size was found to differ for species collected both in Douglas County, Kansas, and in Milwaukee County, Wisconsin. Populations of *E. vestita, E. caryata,* and *E. acericola,* were much larger in Douglas County than in Milwaukee County. Population

size of *E. casta* and *E. querci* were much larger in Milwaukee County than in Douglas County, while *E. apicata* was in equal abundance in both places and *E. venusta* was only found in Milwaukee County.

These studies have led the author to regard the following species as distinct although population studies could not be made for all of the species. In some cases where only a few specimens of a distinct color form were on hand the author has preferred to refrain from describing these as distinct species until sufficient material can be seen and adequate studies have been made to show host relationships.

This genus is Nearctic in distribution.

Because of the great similarity of structure of the male genitalia, only *Empoa spinosa* and *E. albicans* have been found to have genitalia distinctly different enough for recognition on the basis of these characteristics. The rest of the species have male genitalia which may be characterized by the following description:

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly vertical, dorsal angle rounded apically, ventral angle reduced, ventral and posterior margins nearly continuous.

Internal male genitalia.—Aedeagal shaft with median plate on apical half of anterior margin produced as a hook which arises from the base of plate rather than from middle as seen in *Empoa spinosa,* shape of hook variable within a species; median pair of apical shaft processes of aedeagus strongly curving mesad and crossing near middle, second pair of apical processes shorter than median pair and diverging laterodorsad, lateral pair of apical processes nearly straight, curving laterad and of nearly equal length to median pair.

KEY TO THE SPECIES OF EMPOA

1. Median plate on anterior margin of aedeagal shaft smoothly rounded, not forming a hook (Pl. LXXXVIII, fig. 1b); fore wing without spots or apical band of color along cross veins, *albicans* p. 1206

   Median plate on anterior margin of aedeagal shaft forming a hook; fore wing with spots or apical band along cross veins . . 2

2. Hook on anterior margin of shaft of aedeagus arising from the middle of plate (Pl. LXXXVIII, figs. 2b, c); median apical pair of processes of aedeagus slender, slightly curving mesad and crossing on outer fourth . . . . . *spinosa* p. 1205

   Hook on anterior margin of shaft of aedeagus arising from base of plate (Pl. LXXXVIII, figs. 3b, c); median apical pair of processes of aedeagus broadly flattened, sharply curving mesad and crossing near middle 3

3. With pronotum brown or black (host *Ulmus fulva*) ..... *vestita* p. 1204
   With pronotum light colored 4
4. With scutellum brown or black 5
   With scutellum neither brown nor black but sometimes deep yellow 14
5. With only two transverse brown or black bands on fore wing 7
   With brown or black markings more extensive 6
6. With dark markings on fore wing covering most of basal half of wing, but not connecting with apical band (host *Tilea americana*) ..... *venusta* p. 1201
   With dark markings on fore wing extending from base of wing to cross veins, joining apical band with median band (host possibly *Salix* sp.) ..... *scripta* p. 1202
7. Length 3.75-4.0 mm., median band on fore wing one half to one third as broad as width of wing; apical band of fore wing as broad or broader than median band (host *Alnus* sp.), *latifasciata* p. 1203
   Length 3.75 mm. or less, median band usually less than one third as broad as width of wing; apical band narrower than median band 8
8. Fore wing with brown or black spot absent from first basal cell, or reduced to a faint trace along cross vein 9
   Fore wing with brown or black spot present in first basal cell, usually two thirds as long as width of cell 10
9. Length 3.0-3.5 mm., ground color yellow, subhyaline to hyaline (host *Carya ovata*) ..... *caryata* p. 1198
   Length 3.25-3.75 mm., ground color milky white, opaque (host *Acer saccharinum*) ..... *acericola* p. 1200
10. Fore wing with apical band of five spots, in inner three basal and inner two apical cells; median band frequently not reaching costal margin; sometimes restricted to clavus; scutellum pale yellowish brown (host *Platanus occidentalis*) ..... *platana* p. 1199
    Fore wing with apical band of more than five spots, median band extending to costal margin; scutellum chestnut-brown, chocolate-brown, or yellow-brown 11
11. Scutellum pale yellowish brown to yellow, usually light colored; median band of fore wing narrow, one fourth to one fifth as broad as fore wing (hosts *Quercus alba, Q. macrocarpa,* and other white oak species) ..... *casta* p. 1196
    Scutellum usually dark colored, chestnut to dark chocolate brown; median band of fore wing usually one third to one fourth as broad as fore wing 12
12. Fore wing with median band narrow, one fourth to one fifth as broad as fore wing, margins nearly straight (host *Alnus* sp.), *gillettei* p. 1200
    Fore wing with median band broad, one fourth to one third as wide as fore wing, margins irregular 13
13. Fore wing with median band broad, nearly one third as broad as fore wing, broadest near middle, narrowing toward margins of wing (host *Tilea americana*) ..... *venusta* p. 1201

Fore wing with median band less broad, usually only one fourth as broad as fore wing, usually somewhat irregular in outline, but of nearly uniform width throughout (host ? *Salix* sp.), *scripta* p. 1202

14. Fore wing with two transverse bands 18
Fore wing with one transverse band near apex 15
15. Length 2.75-3.0 mm. (host *Ostrya virginiana*) ..... *apicata* p. 1195
Length 3.25-3.75 mm. (host *Quercus* or *Ulmus*) 16
16. Fore wing without brown spot in first basal cell, with only three brown spots, in second and third basal and first apical cells (hosts *Quercus borealis* and *Q. palustrus*) ..... *querci* p. 1193
Fore wing with brown spot in first basal cell 17
17. Fore wing with distinct lunate white markings anterior to brown spots in inner three basal cells and fourth apical cell; ground color pale rose to bright red orange (host *Quercus* sp.), *aureotecta* p. 1193
Fore wing without distinct white markings; ground color a uniform orange-yellow or whitish-hyaline 18
18. Fore wing opaque yellowish-white to orange-yellow, with four to five brown spots in inner three basal and in inner two apical cells; without any traces of a median band (host *Ulmus americana*) ..... *elmata* p. 1194
Fore wing hyaline to subhyaline, pale yellow to whitish, sometimes with faint traces of a median band, with four to eight spots along cross veins making up apical band (hosts *Quercus alba, Q. macrocarpa* and other species of the white oak group), *casta* p. 1196
19. Fore wing with median band nearly uniform in width and parallel sided; apical band with brown spot usually absent from inner basal cell, scutellum frequently light colored (host *Carya ovata*) ..... *caryata* p. 1198
Fore wing with median band irregular in width, color pale yellowish brown; brown spot present in inner basal cell of fore wing 20
20. Fore wing with apical band composed of five spots, in inner three basal and inner two apical cells; median band frequently not reaching costal margin, sometimes limited to clavus, band one fourth to one third as wide as wing; ground color opaque milky white to bright yellow (host *Platanus occidentalis*) ..... *platana* p. 1199
Fore wing with apical band usually composed of four to eight black spots along cross veins; median band very narrow, in most cases one fourth to one fifth as wide as wing; wing hyaline to whitish subhyaline, rarely opaque (hosts *Quercus alba, Q. macrocarpa* and other species of the white oak group), *casta* p. 1196

THE QUERCI GROUP

The species of this group are characterized by having only an apical band of spots on the fore wing when fully matured.

Empoa querci Fitch

(Pl. LXXXVIII, fig. 3)

Empoa querci Fitch, Ann. Rpt. New York State Cab. Nat. Hist., vol. 4, 1851, p. 63. (Reprint) Rpt. New York State Mus. Nat. Hist., vol. 46, 1893, p. 403.
Typhlocyba querci, Woodworth, Psyche, vol. 5, no. 157-159, May-July, 1889, pp. 214.
Typhlocyba gillettei var. *fitchii* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 25, pls. 1-6.
Typhlocyba querci var. *querci*, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, 1952, p. 103.

Resembling *Empoa elmata* but distinguished from this species by lacking brown spot in inner basal cell of fore wing.

Length.—3.25-3.5 mm.

Color.—Head, pronotum, and scutellum white to bright yellow-orange in deeply colored specimens; fore wing white to bright yellow-orange to shortly anterior to cross veins, with brown spots in apices of second and third basal and in first apical cells, rarely with traces of dark color in first basal cell, and slight traces of brown color at bases of second and fourth apical cells; veins white to yellow-orange, hyaline areas anterior to cross veins in inner three basal cells, apical cells hyaline.

Specimens of this species have been collected on *Quercus borealis* and *Q. palustrus* in Douglas County, Kansas, and from *Q. borealis* in Milwaukee, Wisconsin, by the author.

Specimens have been seen from the following localities: *Tennessee:* Gatlinburg, July 21; *Kentucky:* Jellico, August 15; *North Carolina:* Brevard, June 20; *Michigan:* Muskeegon, July 21; *Wisconsin:* Milwaukee, June 30-July 5; *Kansas:* Douglas County, June 6, 8, 10, 12, 14; *Arkansas:* Fayetteville.

Types.—Allotype female of *Typhlocyba gillettei* var *fitchii,* Washington, D. C., here designated neoholotype of *querci,* and holotype male of *Typhlocyba gillettei* var. *fitchii,* Washington, D. C., July 16, 1885, here designated neoallotype of *querci,* in the U. S. National Museum Collection.

Empoa aureotecta Sanders and DeLong

Empoa aureotecta Sanders and DeLong, Ann. Ent. Soc. America, vol. 10, no. 1, March, 1917, pp. 93-94, pls. 8-9.
Typhlocyba aureotecta, McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 20, 26, 40, 42.
Typhlocyba gillettei var. *russeola* McAtee, *loc. cit.*, p. 26, (*new synonymy*).
Typhlocyba gillettei var. *saffrana* McAtee, *op. cit.*
Typhlocyba querci var. *russeola,* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 103.
Typhlocyba querci var. *saffrana,* Young, *op. cit.*

Resembles *Empoa elmata* in color pattern, but differs in having

fore wing with distinct lunate white marks anterior to brown spots of apical band.

Length.—3.25-3.75 mm.

Color.—Head, pronotum, and scutellum yellowish white to orange-yellow; fore wings with ground color light rose to bright reddish-orange, extending to shortly basad of cross veins, with brown spots in apices of three inner basal, and in first and fourth apical cells, lunate white spots anterior to spots in inner three basal and fourth apical cells; remaining areas of apical cells fumose hyaline; abdomen yellow to reddish-orange, without dark markings.

The reported host for this species is *Quercus* sp.

Specimens have been seen from the following localities: *Virginia:* Mountain Lake, July 11; *New York:* Heart Lake, Essex County, August 25; *Pennsylvania:* Northeast, July 4; *Ohio:* Delaware County, June 26, July 20; *Wisconsin:* Osceola, July 20; Madison, July 9; Milwaukee, June 28.

Types.—Holotype female, in the collection of D. M. DeLong, Columbus, Ohio; *neoallotype* male, Milwaukee, Wisconsin, June 28, 1950, P. J. Christian, and one *paraallotype* male, Delaware Co., Ohio, June 26, 1947, D. J. & J. N. Knull, here designated, in the Snow Entomological Collections of the University of Kansas; *paraallotype* males: two, Mountain Lake, Virginia, July 11, 1938, and one, July 23, 1940, L. J. and M. J. Milne, in the U. S. National Museum Collection.

Empoa elmata sp. nov.

Resembling *Empoa aureotecta* specimens which tend toward yellow-orange in color, but differs by not having distinct white lunate spots anterior to apical band of spots on fore wing.

Length.—3.5 mm.

Color.—Head, pronotum, and scutellum milky white to bright orange yellow; fore wings whitish-hyaline to opaque milky white, yellow, or orange yellow, usually with four to five small brown spots along cross veins in inner three basal and inner two apical cells, rarely with apical half of fourth and all of third apical cells brown; apical cells whitish or yellowish hyaline; abdomen with dorsum of each segment black or brown on basal half, apical half yellow, lateral sixth entirely yellow on some specimens, venter with basal three segments black on basal half, remaining portions yellow.

This species has been collected by the author on *Ulmus americana* in Milwaukee, Wisconsin, and in Douglas County, Kansas.

Types.—Holotype male and sixteen male paratypes, Douglas

County, Kansas, June 4, 1949, P. J. Christian; allotype female and one male paratype, Douglas County, Kansas, June 6, 1949, P. J. Christian; additional paratypes as follows: two males and two females, Cheboygan County, Michigan, July 18, 1935, H. B. Hungerford; one male, Long Lake, New York, July 28, 1946, L. D. Beamer; one male, June 8, one male, June 11, one male, June 13, two males, June 14, 1929, and four males June 3, 1930, Douglas County, Kansas, P. B. Lawson; one male, June 5, 1948, Wichita, Kansas, P. J. Christian; one male, Jefferson County, Kansas, June 15, 1950, P. J. Christian; one male, May 27, six males, May 30, nine males, May 31, one male, June 1, one male, June 7, five females, June 14, three females, June 18, two females, June 24, 1949, one male, June 5, one male, June 6, four males, June 12, and three females June 21, 1950, Douglas County, Kansas, P. J. Christian; thirty-seven males, June 27, five males, June 8, three males, June 29, eight males and one female, July 1, one female, July 2, five males and two females, July 3, 1950, Milwaukee, Wisconsin, P. J. Christian; allotype female of *Typhlocyba gillettei* var. *saffrana,* Douglas County, Kansas, August, 1923, W. Robinson, in the Snow Entomological Collections of the University of Kansas; one male paratype June 10, 1947, Louisville, Kentucky, D. A. Young, in the U. S. National Museum Collection; one male, Sta. 10, August 11, 1924, a-52, in the collection of Dr. D. M. DeLong.

Empoa apicata (McAtee)

Typhlocyba gillettei var. *apicata* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 25-26.
Typhlocyba querci var. *apicata,* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 103.

Resembling single-banded specimens of *Empoa casta,* but easily distinguished by being smaller in size, and occurring on *Ostrya virginiana* rather than on species of *Quercus.*

Length.—2.75-3.0 mm.

Color.—Head, pronotum, and scutellum white to light yellow; fore wings white to deep yellow-orange, with a transverse band of black spots along cross veins in inner three basal and in first, base of second, and most of third and fourth apical cells; abdomen with dorsum of basal three segments black medially, dorsum of pygofer and anal tube black, venter white to light yellow.

This species has been collected by the author from *Ostrya virginiana* in Milwaukee, Wisconsin, June 27, 28, July 5, and in Douglas County, Kansas, May 30, June 1, 7, in association with *Ribautiana parapiscator* and *R. multispinosa.*

Type.—Holotype male and paratypes in the U. S. National Museum Collection; paratypes in Illinois State Natural History Survey Collection; *neoallotype* female, Douglas County, Kansas, June 7, 1950, P. J. Christian, here designated, in the Snow Entomological Collections of the University of Kansas.

The type series of McAtee includes a number of specimens of *Empoa casta* from *Quercus alba,* but the holotype is more nearly like specimens from *Ostrya virginiana* than from *Quercus alba.*

THE CASTA GROUP

The species of this group are characterized by usually having only the apical and median bands dark.

Empoa casta (McAtee) (*new combination*)

Typhlocyba gillettei var. *casta* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 26-27.
Typhlocyba querci var. *casta,* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 103.

Resembling *Empoa caryata* in color markings, but distinguished by specimens of the same sex being .25-.5 mm. longer, by having median band usually noticeably irregular, and occurring on species of *Quercus* rather than on *Carya.*

Length.—3.25-3.75 mm.

Color.—Head, pronotum, and scutellum usually pale yellowish-white to light yellow, scutellum sometimes deep yellow to light yellow-brown; fore wings yellowish-white to whitish-hyaline, with a narrow light brown median crossband irregular in outline, sometimes indicated by several spots or only by slight traces of brown at the costal margin, apical band of the same color, variable in the number of spots from only four in inner three basal and first apical cells to eight or nine in inner three basal and apical cells; abdomen with dorsum of each segment black on basal half, venter with basal half of each segment black in males, females with venter usually yellow or white. Specimens with only four spots making up the apical band usually lack the median band also.

This species was found to be very abundant in Milwaukee, Wisconsin, where the author collected over a thousand specimens from a wide variety of plants. Many of the specimens taken were seeking shelter from the wind, but specimens were found to consistently occur on *Quercus macrocarpa* and *Ulmus americana.* Specimens from these two hosts form a complete, closely intergrading series extending from typical *casta* specimens to typical *elmata* specimens.

In Douglas County, Kansas, specimens were found to be abundant

on *Quercus macrocarpa* in 1949, and were of the typical *casta* pattern, while specimens were rare on *Ulmus americana*, and were consistently specimens of the *elmata* pattern, lacking intergrading specimens between these two species.

Because of the sharp line of distinction between these forms in Douglas County, Kansas, the author has chosen to regard them as distinct species. The intergradation which is found in the specimens from Milwaukee may be due to a shift of specimens from one host to another during a part of their development, resulting in specimens which are extremes in variation from the typical forms which are intermediate between the typical forms.

Specimens from a white oak species in Arizona, and specimens from *Quercus alba* from Milwaukee, Wisconsin, are indistinguishable from typical specimens of *casta* found on *Quercus macrocarpa*, but show no tendency toward a development of intermediate specimens as are found on *Quercus macrocarpa*.

A series of specimens from *Quercus* species? from Franklin, North Carolina, differs from typical *casta* specimens in being slightly larger in size, and in having the median transverse band sharply distinct with smooth margins and the ground color of opaque light yellow. This form may eventually prove to be a distinct species.

Specimens have been seen from the following localities: *Ontario:* Brockville, August 12; *Massachusetts:* Woods Hole, July 7; *New York:* Canisteo, August 14; Elba, August 23; Ithaca, June 17, 27; Minetto, August 30; West Nyack, June 11; Sea Cliff; *Pennsylvania:* Hummelstown, July 7; Duncannan, June 24; *West Virginia:* Great Cacapon, July 4; *Washington D. C.*, June 4; *Virginia:* Mountain Lake, July 12, 23; *Kentucky:* Berea, June 14; *Tennessee:* Gatlinburg, June 20, 24, 25; *North Carolina:* Franklin, August 17; Cherokee, July 19; Raleigh, June 20; *Florida:* Ocala, April 29; *Ohio:* Summit County, June 17; Barberton, August 13; Wooster, July 5, 8; Columbus, October 16; *Illinois:* Urbana, June 8, 9; Bellwood, June 21; Aroma Park, July 8; Bell Smith Springs, July 16; Palos Park, June 23; Roseville, September 1; *Wisconsin:* Milwaukee, June 26-July 5, 18; Madison, July 2, 9; Cranmoor, June 21, 27, September 3; Wisconsin Rapids, June 21; Blue River, July 28; Lake Wingra, July 18; *Minnesota:* St. Anthony Park, June 23; Itasca County, July 26, 28, 29; St. Paul, August 25; Ramsey County, July 20; *South Dakota:* Custer, August 26; *Iowa:* Ames, June 16, September 20-22; Muscatine, June 10, 15; Ledges State Park, June 29; *Missouri:* Neosho, May 28; *Arkansas:* Washington County, June 30; Rodgers, July 10; *Louisiana:* Madi-

sonville, June 11; *Kansas:* Douglas County, June 2-July 20; Wyandotte County, June 23; Leavenworth County, June 28-30; Atchison County, July 10; Coffey County, June 19; Jefferson County, June 15; Cherryvale, June 9; Leon, June 20; *Colorado:* Royal Gorge, July 3; Garden of the Gods, August 19; Ft. Collins, August 6; Sloss, August 17; Creede, July 22; *Arizona:* Oak Creek Canyon, August 9; *New Mexico:* Sapello, July 25; Ruidoso, October 6.

Empoa caryata sp. nov.

Resembling *Empoa casta* but differing in having color markings chestnut brown rather than yellowish-brown, in having dark spot absent from inner basal cell or reduced to only a slight trace, in having margins of median band sharply defined and smooth, and in occurring on species of *Carya* rather than species of *Quercus.*

Length.—3.0-3.5 mm.

Color.—Head and pronotum whitish-yellow to yellow, scutellum usually of the same color but sometimes chestnut brown; fore wings with chestnut brown markings forming a narrow median transverse band one third as broad as long and usually parallel sided, sharply distinct from ground color, apical band composed of chestnut brown spots in second and third basal, all of first, base of second, and all of third apical cells, rarely a trace of dark color in first basal cell, ground color of fore wing pale white to light yellow; abdomen white to light yellow, usually without dark markings.

Types.—Holotype male, allotype female, two male and thirty-seven female paratypes, Douglas County, Kansas, June 11, 1949, P. J. Christian; additional paratypes: one female, July 5, two males and one female, July 1, 1939, Clarksville, Tennessee, R. H. Beamer; one female, August 16, 1946, New Haven, Connecticut, R. H. Beamer; two males and one female, Tuskahoma, Oklahoma, R. H. Beamer; ten males and forty-one females, June 11, 1949, Douglas County, Kansas, R. H. Beamer; one female, Rosedale, Kansas, June 23, 1928, E. P. Breakey; two males and three females, June 12, thirty-three females, June 19, one female, June 21, thirteen females, June 24, two females, June 28, 1949, one male and twenty-two females, June 10, four males and four females, June 12, 1950, Douglas County, Kansas, P. J. Christian; eight males and fourteen females, June 30, two males, July 4, 1950, Milwaukee, Wisconsin, P. J. Christian, in the Snow Entomological Collections of the University of Kansas; one male and five females, July 9, 1948, Ross and Burks, (on hickory), N. Chicago, Illinois, in the Collection of the Illinois State Natural History Survey; one female, June 22, 1918, Mercer County,

Ohio, R. F. Hussey, (on *Carya* sp.), in the University of Michigan Collection; one male and six females, July 2, 1939, Ithaca, New York, P. A. Readio; one male, Elba, New York, in the Cornell University Collection.

Empoa platana sp. nov.

Resembling *Empoa casta* in having scutellum light colored but differing in having apical band composed of only five brown spots in inner three basal and inner two apical cells, median band frequently not reaching costal margin, and ground color opaque milky-white.

Length.—3.25-3.75 mm.

Color.—Head and pronotum chalky or milky-white to pale yellowish-white, scutellum pale yellowish-brown on disc; fore wing with ground color chalky white to yellow, with a narrow light brown median band sometimes extending to costal margin, sometimes restricted to clavus, apical band composed of five light brown spots in inner three basal cells and in inner two apical cells; cross veins and apical veins milky white, a border of the same color the width of vein along veins; apical cells whitish-hyaline with traces of brown along outer margins of third and fourth apical cells; abdomen chalky white to light yellow without dark markings.

The host plant for this species is *Platanus occidentalis.*

Types.—Holotype male, allotype female, Louisville, Kentucky, June 10, 1947, in the U. S. National Museum Collection; paratypes: three males and four females, same data as type, in the collection of Dr. D. A. Young, Jr.; two females and two males, same data as type, in the Snow Entomological Collections of the University of Kansas; three females, Columbus, Ohio, October 20, 1920, in the University of New Hampshire Collection; two females, Lexington, Kentucky, August 27, 1915, in the U. S. National Museum Collection; one male and three females, Harrisburg, Pennsylvania, June 13, 1921, in the collection of Dr. D. M. DeLong.

THE GILLETTEI GROUP

The species of this group are characterized by usually having the scutellum dark colored and by having a median and apical band of the same color. Some of the species in this group show polymorphism, having forms with color patterns which are more extensive than the pattern found on specimens of *Empoa gillettei.*

Empoa gillettei Van Duzee (*new combination*)

Typhlocyba bifasciata Gillette and Baker, Bull. Colorado Agr. Exp. Sta., no. 31, Tech. ser. no. 1, 1895, p. 111. (nec. *bifasciata* Boheman, 1852).
Empoa bifasciata, Van Duzee, Check List of Hemiptera (excepting the Aphididae, Aleurodidae and Coccidae) of America North of Mexico, 1916, p. 77.
Empoa querci var. *bifasciata,* Sanders and DeLong, Ann. Ent. Soc. America, vol. 10, no. 1, 1917, p. 93.
Empoa querci var. *gillettei* Van Duzee, Tech. Bull, California Agr. Exp. Sta. Ent., vol. 2, 1917, p. 708. (nom. nov. for *Typhlocyba bifasciata* Gillette and Baker).
Typhlocyba querci var. *gillettei,* McAtee, Canadian Ent., vol. 51, no. 8, 1919, p. 225.
Typhlocyba gillettei var. *gillettei,* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 23-24, 27-28.

Resembling *Empoa acericola* but differing in having spot in inner basal cell as large as in other basal cells, median band nearly parallel margined, ground color deeper yellow, and in occurring on *Alnus* sp.

Length.—3.25-3.5 mm.

Color.—Head white, pronotum white with yellow markings on anterior half, laterad of disc; scutellum deep orange yellow to light yellowish brown; fore wings light yellowish white, subhyaline, with a narrow transverse chestnut-brown median band one third to one fifth as broad as width of wing, with an apical band of the same color over cross veins filling apices of inner three basal cells and most of apical cells, apical two thirds of second apical cell fumose hyaline and less deeply colored than other apical cells; abdomen yellow with basal half of dorsum of three basal segments black, dorsum of male pygofer, and anal tube chestnut brown, venter yellow or whitish yellow.

A large series of specimens collected on *Alnus,* Carrizo Creek, Arizona, June 16, 1950, seen by the author, more nearly resemble the type of *Typhlocyba bifasciata* Gillette and Baker, from Colorado, than do specimens of any of the other species in the group.

Types.—Holotype female, type of *Typhlocyba bifasciata* Gillette and Baker, in the U. S. National Museum Collection.

Empoa acericola sp. nov.

Resembling *Empoa gillettei* in color pattern but distinguished by lacking dark spot in inner basal cell of fore wing.

Length.—3.25-3.75 mm.

Color.—Head and pronotum milky-white to light yellow; scutellum chestnut-brown; fore wing with a median transverse chestnut-brown band one third as wide as width of fore wing, of nearly uniform width, margins somewhat irregular, an apical band of same color composed of spots in second and third basal cells, and in all

of first, basal third of second, and apical two thirds of fourth apical cells; apical two thirds of second and all of third apical cells strongly fumose-hyaline, areas anterior to bands milky-white to light yellow; abdomen with dorsum of basal three segments brown on basal half, dorsum of pygofer and anal tube brown, venter white to yellow.

This species has been collected by the author in Douglas County, Kansas, and in Milwaukee, Wisconsin, from *Acer saccharinum.*

Types.—Holotype, allotype, and three female paratypes, June 12, 1950, Douglas County, Kansas, P. J. Christian; additional paratypes: two males, June 9, one male, June 15, one male, June 19, 1940, Muscatine, Iowa, and one male, June 12, 1940, Davenport, Iowa, D. R. Lindsay; two males and one female, June 5, one female, June 28, 1949, Douglas County, Kansas, R. H. Beamer; one male, May 31, two males and six females, June 6, two females and one male, June 7, one female, June 9, one female, June 15, two females, July 1, one female, July 15, 1949; seven males, June 3, six males, June 5, twenty-two males, June 8, three males and seven females, June 10, one male and seven females, June 21, 1950, Douglas County, Kansas, P. J. Christian; five males, June 28, five males, June 29, two males and two females, June 27, 1950, Milwaukee, Wisconsin, P. J. Christian, in the Snow Entomological Collections of the University of Kansas.

Empoa venusta (McAtee) (*new combination*)

Typhlocyba gillettei var *venusta* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 29.
Typhlocyba querci var. *venusta,* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 103.

Resembling *Empoa gillettei,* but distinguished by having median band usually broader at middle than at margins. Dark form distinguished by having anterior half of fore wing chestnut-brown except for a narrow yellow band along costal margin.

Length.—3.25-3.75 mm.

Color.—Head and pronotum yellowish white to bright yellow; scutellum chestnut-brown, apex sometimes yellow; fore wing with a broad, transverse, chestnut-brown median band, its greatest width half as broad as wing, apical band chestnut-brown, composed of spots in inner three basal cells and all of first, basal third of second, all of third and apical two thirds of fourth apical cells, whitish yellow to yellow on basal fourth of wing and between bands, a narrow whitish-hyaline band basad of dark spots in basal cells and in basal third of fourth apical cell, disc of second apical cell hyaline; dark form specimens differ in having area anterior to median band also chestnut-brown except for a narrow yellow band

along costal margin; abdomen yellow with dorsum of basal three segments chestnut-brown, some specimens with basal half of dorsum of all segments chestnut-brown.

A large series of specimens of this species has been collected from *Tilea americana,* in Milwaukee, Wisconsin, by the author.

Specimens have been seen from the following localities: *New Hampshire:* Bretton Woods, August 31; *Connecticut:* New Haven, August 16, 18, 20; *New York:* Albany, June 20; Minetto, August 18, 20, 24, 30; *Ontario:* Trenton, August 25, 29; Vineland Station, June 16; Ottawa, June 27; Toronto, August 8; *Ohio:* Sandusky, Cedar Point, July 11; Barberton, August 13; Milan, September 1; Cleveland, September 3; *Michigan:* Lake Gogebic, August 18; Cheboygan County, July 30; *Minnesota:* Itasca County, July 20, 26; *Wisconsin:* Amery, August 11, 13; Polk County, July; Wisconsin Rapids, August 11; Milwaukee, June 26-July 7; *South Dakota:* Brookings, June 17, 27, July 4, August 10, 17, September 15; Big Stone, August 27.

Types.—Holotype male, allotype female, and paratype male in U. S. National Museum Collection; paratype male in the Snow Entomological Collections of the University of Kansas.

Empoa scripta (McAtee) (*new combination*)

Typhlocyba querci var. *scripta* McAtee, Canadian Ent., vol. 51, no. 8, 1919, p. 226.
Typhlocyba gillettei var. *scripta,* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 28.
Typhlocyba gillettei subsp. *oregonensis* Beamer, Canadian Ent., vol. 75, no. 7, 1943, p. 133. (*new synonymy*).
Typhlocyba querci var. *scripta,* Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 103.

Resembling *Empoa venusta* in color pattern of lightly marked forms, distinguished in some cases by having median transverse band of nearly uniform width throughout its length, dark color pattern easily distinguished by having a longitudinal dark marking connecting median and apical bands.

Length.—3.25-3.75 mm.

Color.—Head and pronotum yellowish white to yellow, scutellum chestnut-brown to dark yellow-brown; fore wing with variable pattern of chestnut-brown markings, usually with median transverse band nearly half as broad as fore wing, apical band of spots in apices of inner three basal cells, in all of first, base of second, and in apical two thirds of fourth apical cells, ground color yellowish-white to light yellow; some heavily marked specimens with longitudinal stripe from base of fore wing to cross veins, clavus yellow to white along basal and apical third of commissural margin, outer

two basal cells yellow to white on basal and apical third; very heavily marked specimens with only a narrow band of yellow on basal and apical third of outer basal cell.

Partly teneral specimens are light yellowish brown, but have the same color pattern. The type series of *Typhlocyba gillettei* var. *oregonensis* is composed entirely of such specimens.

The host for this species is not known definitely, but field notes made at the time of collection of several short series of specimens, include only willow and alder. None of the specimens seen from alder are like specimens of this species so that the more likely host is some species of willow (Salix).

Specimens have been seen from the following localities: *Tennessee:* Great Smoky Mountains National Park, June 24, July 20, September 1; *New York:* Onteora Mountain, Green County; Keene Valley, Essex County, August 24; *Idaho:* Bliss, July 7; *Oregon:* Dixie, Grant County, July 8; Haines, Baker County, July 10; *British Columbia:* Hope, August 1.

Types.—The holotype female of this species was destroyed by fire in 1946, in the Nova Scotia Department of Agriculture. A female specimen, Alum Cave Area, Great Smoky Mountains National Park, September 1, 1948, Ross and Stannard, agreeing with the description of the type in every particular, here designated *neohol-otype*, in the Illinois State Natural History Survey Collection; a male specimen, Hope, British Columbia, August 1, 1931, R. H. Beamer, agreeing with the type description, here designated *neoallotype*, in the Snow Entomological Collections of the University of Kansas.

Empoa latifasciata sp. nov.

Resembling *Empoa spinosa* in size and in color pattern, but easily distinguished from this species by having hook on anterior margin of apical half of aedeagal shaft arising from base of median plate rather than from middle.

Length.—3.75-4.25 mm.

Color.—Head and pronotum white to bright yellow; scutellum chestnut-brown; fore wings with a broad transverse median band of chestnut-brown one half as broad at commissural margin as width of fore wing, reduced to nearly half this width at costal margin, posterior margin of band nearly straight but with anterior margin strongly rounded, apical band of same color covering apices of inner three basal cells and all of apical cells, apical cells subhyaline with apical two thirds of second apical cell hyaline, veins in apical band usually fumose, area anterior to median band and between median

and apical bands whitish-yellow to orange-yellow with whitish-hyaline areas anterior to apical band in inner three basal cells.

A large series of specimens has been collected from a species of *Alnus* in Sapello, New Mexico.

Types.—Holotype male, allotype female, eight male and twenty-eight female paratypes, July 24, 1950, Sapello, New Mexico, R. H. Beamer; three female paratypes, August 1, 1931, Hope, British Columbia, R. H. Beamer; one female paratype, August 13, 1928, Harris County Texas, L. D. Beamer, in the Snow Entomological Collections of the University of Kansas; one female, August 1, 1916, Maine Agricultural Experiment Station, Orono, Maine; one female, September 7, 1922, Durham, New Hampshire; two females, September 2, 1928, Fabyans, New Hampshire; 1 female August 19, 1928, Alton, New Hampshire, in the New Hampshire State University Collection.

THE VESTITA GROUP

This group is characterized by having the pronotum dark colored. At present it is represented by only one species although three specimens of one, and single specimens of two other color forms which may prove to be species of this group have been seen by the author. Until the hosts for these are known and a sufficient number of specimens is on hand to be able to tell whether or not these are distinct species or only extremes of variability of some described species, the author considers it best for them to remain undescribed.

Empoa vestita (McAtee) (*new combination*)

Typhlocyba gillettei var. *vestita* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 29.

Typhlocyba querci var. *vestita* McAtee, Young, Bull. Univ. Kansas Sci. Bull., vol. 35, pt. 1, 1952, p. 103.

Resembling the most darkly colored specimens of *Empoa scripta,* but easily distinguished by having the pronotum and usually the head dark chocolate-brown or greenish brown.

Length.—3.25-3.5 mm.

Color.—Head, pronotum, and scutellum greenish- or yellowish-brown to chocolate-brown; fore wings greenish- to yellowish-brown, rarely deep chestnut-brown, with areas in apices of inner three basal cells and areas of apical cells bordering on cross veins deeper brown, veins on apical third of fore wing lighter than surrounding areas, costal vein yellow to reddish-brown, deeply colored specimens of uniform color intensity throughout; face, venter of thorax, and venter of abdomen yellow; basal half of each abdominal segment dark brown; male plates yellow to buff.

More than a thousand specimens of this species have been collected from *Ulmus fulva* in Douglas County, Kansas, where it has been very abundant. A few specimens were taken from the same host in Milwaukee, Wisconsin.

Specimens have been seen from the following localities: *New York:* Norris, August 15; *Pennsylvania:* Greensburg; *Michigan:* Cheboygan County, July 16; *Wisconsin:* Amery, August 14; Milwaukee, June 27-July 4; *Illinois:* Castle Rock, Grand Detour, July 2; Apple River Can. State Park, July 11; *Kansas:* Clay Center, July 2; Douglas County, June through July.

Types.—Holotype male, allotype female, and paratypes, in the Snow Entomological Collections of the University of Kansas; paratypes in U. S. National Museum Collection.

The Spinosa Group

The species making up this group is marked like some species of the Gillettei Group, but is distinguished by having the aedeagal shaft with hook on anterior margin arising from middle of plate rather than from basal attachment as in all of the species in preceding groups, and with median pair of apical processes equal in length to the second pair of apical processes and crossing near the apex rather than near the middle.

Empoa spinosa (Beamer) (*new combination*)

(Pl. LXXXVIII, fig. 2)

Typhlocyba spinosa Beamer, Canadian Ent., vol. 75, no. 7, 1943, pp. 131-132.

Resembling *Empoa latifasciata* in external appearance, but with hook on anterior margin of aedeagal shaft arising from middle of plate rather than from base.

Length.—3.75-4.25 mm.

Color.—Head and pronotum light to deep yellow; scutellum chocolate brown; fore wings with a broad transverse median band one third to one half as broad as fore wing, apical band chocolate brown and covering apices of inner three basal cells, basal half of first, basal fourth of second, all of third, and all of fourth apical cells; apical half of first and apical three fourths of second apical cells fumose-hyaline or whitish-hyaline, remaining areas of fore wing yellowish white to yellow; abdomen with dorsum of basal three segments entirely chocolate brown, basal half of remaining segments and dorsal half of pygofer chocolate brown, cross veins and apical veins white to slightly fumose, whitish-hyaline areas anterior to apical band in inner three basal cells.

Genital capsule.—Male pygofer with dorsal angle more pronounced than in *Empoa querci,* only slightly rounded at apex, ventral angle broadly rounded, not forming a distinct lobe.

Internal male genitalia.—Aedeagus with median pair of apical processes elongate, crossing at outer fourth, second pair of apical processes equal to median pair in length, with apices nearly meeting, lateral pair of apical processes exceeding both inner pairs in length; median plate on dorsal half of anterior margin of aedeagal shaft produced apically as a large dorsoanteriorly directed hook arising from middle of anterior margin of plate.

Specimens have been seen from the following localities: *Alaska:* Ft. Yukon, July 15; *Colorado:* Sloss, August 17. The type series was collected from huckleberry (*Vaccinium* sp.).

Types.—Holotype male, allotype female, and female paratypes, in the Snow Entomological Collections of the University of Kansas.

THE ALBICANS GROUP

This group composed of only a single species at present, is distinguished from the other species groups by lacking an apical band of dark colored spots, and by having median plate on anterior margin of shaft of aedeagus smoothly rounded rather than produced as a hook.

Empoa albicans Walsh

(Pl. LXXXVIII, fig. 1)

Empoa albicans Walsh, The Prairie Farmer, (n. s.) vol. 10, no. 10, September 6, 1862, p. 149.
Typhlocyba albicans, Woodworth, Psyche, vol. 5, no. 157-159, 1889, p. 214.
Typhlocyba cymba var. *pallens* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 22. (*new synonymy*).
Typhlocyba cymba var. *cymba* McAtee, Canadian Ent., vol. 50, no. 11, 1918, pp. 360-361.
Typhlocyba cymba var. *grata* McAtee, Canadian Ent., vol. 51, no. 8, 1919, p. 226.
Typhlocyba cymba var. *unipuncta* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 23. (nec. *Typhlocyba unipuncta* Matsumura, 1908).

Resembling *Typhlocyba putmani, T. attenuata,* and *Edwardsiana dejecta* in size and outward appearance when lacking dark markings on dorsum, easily distinguished from these by having three pairs of apical processes on aedeagus.

Length.—4.0-4.5 mm.

Color.—Head, pronotum, and in some specimens entire dorsum yellowish-white to light yellow; scutellum dark brown on specimens with dark markings; fore wings if marked, with dark brown markings varying from having only a trace of a spot in apex of clavus, to having entire clavus and most of inner two basal cells dark brown;

abdomen with basal three segments brown on basal half, venter yellowish white.

Genital capsule.—Male pygofer, in lateral aspect, with ventral angle forming a slight lobe arising mesad of ventral margin; ventral margin obliquely curving dorsocaudad and joining posterior margin near middle.

Internal male genitalia.—Aedeagus with posterior margin of shaft strongly curving dorsad from base, apical processes directed dorsocephalad, median pair nearly parallel to each other, not crossing apically, second pair short, one third length of median pair, lateral pair nearly of equal length to median pair; median plate on dorsal half of anterior margin of shaft of aedeagus evenly rounded, not produced as a hook.

Four short series of specimens each of which includes three or four of the described varieties of McAtee have been seen. In addition to these varieties, intermediate forms also occur and seem to indicate that these forms are only stages in the maturing of some adult specimens such as has been seen in other species of the genus. A single specimen with only the scutellum dark brown has been seen, which seems to indicate that some specimens may terminate color formation at various stages before attaining full coloration. Other specimens entirely lacking dark markings also appear to be fully matured. These may prove to be only color forms of a single species with various individuals terminating color formation at different stages, or they may prove to be specimens of closely related species. Because of insufficient numbers of specimens and inability to study this species in the field, the author has not been able to settle this question.

In the absence of the type specimen of *Empoa albicans* the identity of this species has long been held in question. The original description, reprinted below, is sufficient to indicate that this species belongs in the Typhlocyba Complex.

"*Empoa albicans*—New species, whitish. Eyes fuscous. Two or three of the basal and of the terminal joints of abdomen fuscous at tip; ovipositor black; elytra subhyaline, at tip a little cloudy; triangular cell peduncled; apex of vein which forms the inner cell not attaining half the distance to the apex of elytrum; wings hyaline. Length to tip of wings nearly one-fifth of an inch."

After a consideration of all of the North American species in the Typhlocyba Complex, only four species could be found which were whitish, and one sixth of an inch or more in length. Of these four, only one had dark markings on the dorsal segments of the abdomen,

Typhlocyba cymba var. *pallens*. Since this is the only known species which fits the description of the type specimen, the author has placed it in synonymy with *Empoa albicans* although the type variety of *Typhlocyba cymba* has color markings which do not fit the description of *E. albicans*.

Specimens have been seen from the following localities: *Nova Scotia:* Halifax, August 9; Wolfville; *Quebec:* Newaygo, July 30, Ridgland, August 15; *Ontario:* Toronto, July 9; Vineland Station, July 1; *Maine:* Portland, July 9; Mt. Katahdin, August; Mt. Bethel, July 7; *Massachusetts:* Cambridge, August 19; *New Hampshire:* Wonalancet, July 1; Jackson, September 18; Durham, August 21; *New York:* Rock City, July 4; Ithaca, July 26; Gowanda, August 2, 9; Stanford, August 2; Catskill, September 17; Heart Lake, Essex County, August 23; Onteora Mt. Green County; *Michigan:* Cranberry Lake, August 9; Cheboygan County, July 7, 26; Douglas Lake, July 13; Agricultural College, June 21; Lake City, July; *Wisconsin:* Hazelhurst, July 12.

Types.—Neoholotype female, *neoallotype* male, Newaygo, Quebec, July 30, 1929, Parrish, here designated, in the Snow Entomological Collections of the University of Kansas.

The following type specimens of varieties of *Typhlocyba cymba* McAtee have been destroyed by fire in the Nova Scotia Department of Agriculture, in 1946: Holotype specimens of varieties *cymba, grata, pallens,* and *unipuncta;* allotype and paratypes of variety *pallens*. Paratypes of var. *pallens* are in the Illinois State Natural History Survey Collection, and in the U. S. National Museum Collection. Paratypes of var. *unipuncta* are in the Iowa State College Collection, and in the U. S. National Museum Collection.

GENUS EDWARDSIANA Jazykov (Zachvatkin)

(Pls. LXXXIX-XCII)

Edwardsiana Jazykov (Zachvatkin), Rev. Russe d'Ent., vol. 23, nos. 3-4, 1929, pp. 262-265.

Type of the genus, *Cicada rosae* Linnaeus, by original designation.

Fore wings.—Inner and outer apical cells short, not attaining wing apex; second apical cell much broader at apex than at base; third apical cell petiolate; wing apex smoothly rounded.

Hind wings.—Vein 1V branching from vein 2V near its midlength; submarginal vein absent at wing apex; both apical cells open apically; posterior branch of R fused with apical portion of vein M_{1+2}.

Genital capsule.—Male plate in ventral aspect, broad on basal

half, strongly reduced near middle, in lateral aspect gradually curved dorsad on apical half, apical third slightly enlarged but not spatulate, a row of short stout setae on outer half submarginally along dorsal margin, a few scattered setae laterally on apex, and a single large macroseta on base of male plate near outer basal angle; pygofer, in lateral aspect, usually broadly rounded, with a protuberance on dorsocaudal margin sometimes enlarged as a broad angular arm, ventral angle forming a broadly rounded lobe, rarely with a short caudally directed hook; a large group of macrosetae just dorsad of outer basal angle of male plate, numerous setae posterior to these and extending across disc, a patch of macrosetae on inrolled margin of dorsal angle.

Internal male genitalia.—Style elongate, slender, curving laterodorsad, with apex abruptly curved lateroventrad and reduced, appearing setiform, a row of setae along outer margin, mesal margin without setae but with a few alveoli on outer third; connective Y-shaped to triangular, slightly longer than broad; aedeagus without atrial processes, shaft usually slender, gradually tapering to apex, rarely with anterior margin inflated, in lateral aspect as a broad thin plate (*rosae*), with two pairs of apical processes unbranched, or with one or both pairs branched; preatrial arm long; aedeagal apodeme a slender bar, laterally compressed, nearly two thirds length of shaft, usually forming an acute angle with the preatrial arm.

Female.—With posterior margin of eighth abdominal sternite strongly produced medially as an acute lobe as seen in *E. rosae.* (Pl. LXXXVII, figs. 13a, b).

The head in dorsal aspect narrower than pronotum, longer medially than next the eye, anterior margin of crown broadly rounded; pronotum short and broad, lateral margins strongly divergent posteriorly, posterior margin smoothly, shallowly convex, pleural portion broader than ocellocular area.

The species are usually pale white or yellow, occasionally with dark markings.

The genus is holarctic in distribution.

The following key to the North American species of the genus is based primarily on characteristics of the male genitalia.

KEY TO THE SPECIES OF EDWARDSIANA

1. Aedeagal shaft with two paired processes and one mesal unpaired process. (Pl. XC, fig. 6) ..... *australis* p. 1220
   Aedeagal shaft with only paired processes 2
2. Aedeagal shaft with one or both pairs of apical processes branching 3
   Aedeagal shaft with apical processes unbranched 10

3. Aedeagal shaft with both pairs of apical processes branching ... 4
   Aedeagal shaft with only mesal pair of processes branching 5
4. With mesal pair of processes branching near base; pygofer only slightly produced on dorsal angle. (Pl. LXXXIX, fig. 1), *lethierryi* p. 1213
   With mesal pair of processes branching near middle; pygofer strongly produced dorsad as a broad triangular projection. (Pl. LXXXIX, fig. 4) ..... *bergmani* p. 1213
5. With lateral pair of apical processes strongly curved laterocaudad. (Pl. XC, fig. 1) ..... *expanda* p. 1215
   With lateral pair of apical processes straight, directed cephalad or dorsad 6
6. Mesal pair of processes fused on basal two thirds, with dorsal branch arising from middle of fused portion. (Pl. XCI, fig. 2), *pseudocommissuralis* p. 1222
   Mesal pair of processes not fused on basal two thirds 7
7. Mesal pair of processes branching near middle. (Pl. XC, fig. 2), *frustrator* p. 1216
   Mesal pair of processes branching near base 8
8. Dorsal branch of mesal processes broad, strongly curving dorsad anteriorly, dorsal margin concave. (Pl. XC, fig. 3) .... *plebeja* p. 1217
   Dorsal branch of mesal processes narrow, nearly straight, directed cephalad 9
9. Apices of branches of mesal processes of aedeagus converging apically, forming nearly a circle in anterior aspect. (Pl. XC, fig. 5) ..... *candidula* p. 1219
   Apices of branches of mesal processes of aedeagus diverging apically. (Pl. XC, fig. 4) ..... *prunicola* p. 1218
10. Anterior margin of aedeagal shaft laterally compressed to a broad flat plate, lateral apical processes broad, curving strongly dorsocephalad, diverging laterad. (Pl. LXXXIX, fig. 2) .... *rosae* p. 1211
    Anterior margin of aedeagal shaft not compressed, lateral apical processes slender, directed dorsad, appearing as a continuation of shaft in lateral aspect 11
11. Pygofer with ventral angle strongly produced as a short acute caudally directed process 12
    Pygofer with ventral angle evenly rounded, or only slightly produced 13
12. Lateral processes of aedeagus half to one third length of mesal processes. (Pl. XCII, fig. 5) ..... *euphrante* p. 1228
    Lateral processes of aedeagus only slightly shorter than mesal processes, mesal processes strongly curved dorsad on apical third. (Pl. XCII, fig. 2) ..... *delongi* p. 1226
13. Mesal processes of aedeagus sharply directed ventrad, convex on anterior margin. (Pl. XCI, fig. 3) ..... *dejecta* p. 1222
    Mesal processes of aedeagus not directed ventrad, straight, or slightly concave on dorsal margin 14
14. With dorsal surface of mesal processes of aedeagus concave, strongly curving dorsad near outer half or third 15
    With dorsal surface of mesal processes of aedeagus straight, or slightly convex 16

15. Lateral processes of aedeagus one third as long as mesal processes; fore wings entirely white. (Pl. XCI, fig. 4) ..... *dorsti* p. 1225
    Lateral processes of aedeagus nearly as long as mesal processes; fore wings with commissural margins black. (Pl. XCII, fig. 1), *nigripennis* p. 1225
16. With mesal processes of aedeagus distinctly shorter than lateral processes 17
    With mesal processes of aedeagus equal to or slightly longer than lateral processes; fore wings with commissural margins and part of clavus usually black. (Pl. XCII, fig. 3) ..... *commissuralis* p. 1223
17. With mesal processes of aedeagus less than half as long as lateral processes, fused on basal third. (Pl. XCI, fig. 1) ..... *projecta* p. 1221
    With mesal processes of aedeagus two thirds as long as lateral processes, not fused on basal third. (Pl. XCII, fig. 4) .... *ariste* p. 1227

Edwardsiana rosae (Linnaeus)

(Pl. LXXXIX, fig. 2)

Cicada rosae Linnaeus, Systema Naturae, ed. 10, 1758, p. 439. (Engelmann Reprint, ed. 10, p. 439, 1894).
Cicada (Tettigonia) rosae, Geoffroy, Histoire d'Insectes, 1762, p. 428.
Typhlocyba rosae, Herrich-Schäffer, Fauna Insectorum Germanicae initia; oder Deutschlands Insecten gesammelt und herausgegeben von D. G. W. F. Panzer. Fortgesetzt von G. A. W. Herrich-Schäffer, vol. 124, 1834, p. 10.
Cicadula rosae, Zetterstedt, Insecta Lapponica, 1840, p. 300.
Tettigonia rosae, Harris, Insects Injurious to Vegetation, 1842, p. 199.
Typhlocyba pteridis Dahlbom, Handlingar. Kongliga Svenska Vetenskaps Akademien, 1850, pp. 179-181.
Anomia rosae, Fieber, Katalogue der europaischen Cicadinen, 1872, p. 15.
Typhlocyba lactea Douglas, Ent. Monthly Mag., ser. 1, vol. 12, 1875, p. 77.
Empoa rosae, Weed, American Garden, July 1889, p. 257.
Edwardsiana rosae, Jazykov (Zachvatkin), Revue Russe, Ent., vol. 23, nos. 3-4, 1929, p. 265.

Resembling *E. candidula* in external appearance, but easily distinguished from this species and other North American species of the genus by having the anterior margin of the aedeagal shaft produced into a flat plate, appearing greatly enlarged in lateral aspect.

Length.—3.5-3.75 mm.

Color.—White to pale yellow, without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly vertical, slightly slanting ventrocaudad; dorsal angle produced, forming an obtuse angle; ventral angle broadly rounded projecting slightly beyond dorsal angle.

Internal male genitalia.—Aedeagus, shaft with anterior margin produced in a flat plate on apical two thirds, appearing greatly swollen near middle in lateral aspect, with both pairs of unbranched apical processes directed laterocephalad, lateral pair greatly broadened near middle, gradually tapering from middle to acute apex, median pair less broad and with apices curving mesad.

A single abnormal male with processes on each side of aedeagal shaft fused for most of their length, resembling var. *manca* of Ribaut

(1936), but differing in having apices of inner pair of processes forming three short branches, has been seen from Catskill, New York, taken with normal males of this species, and has been drawn for comparison with normal specimens. (Pl. LXXXIX, figs. 2f, g).

The approved common name for this species is "The Rose Leafhopper" (Muesbeck, 1950, p. 138).

Specimens taken on *Malus, Rosa,* and *Rubus* have been seen. Specimens seen are from the following localities: *Nova Scotia; Ontario:* Trenton, June 11; *Massachusetts:* Boston, July 27; Lexington, September 16; *New Hampshire:* Durham, August 20, 29; September 3, 7, 11, 13, 14, 22; *New York:* Ithaca, July; Catskill, October 19; *Pennsylvania:* Northeast, June 7, 8, July 4, October 15; Hazelton, June 12; *Ohio:* Cleveland, September 1, Columbus, May 31, Wooster, August 14; *Minnesota:* Ramsay County, August 22; *Wisconsin:* Green Bay, June 10; Milwaukee, June 26-July 5; Bayfield, September 10; Racine, September 7; *Illinois:* Urbana, October 1, November 4, 10; *Iowa:* Davenport, June 8; *Colorado:* Ft. Collins, September 23; *Utah:* Salt Lake, June 4; Logan, June 11, 26; September 20, 22, October 17; Magna, June 7; Millville, August 2, 3, September 13; Providence, July 18, September 19, 22, October 4; Granite, July 16; Riverside, August 12; Provo, September 17; Hooper, October 14, 16; Fountain, October 22; Richfield, June 9, August 7; Farmington, September 27; *Idaho:* Sandpoint, July 3; Shoshone Basin, July 27; Moscow, October 16; Jerome, June 15; *British Columbia:* Oliver, August 6; Vernon, August 5, 23; Vancouver, August 4; Victoria, October 29, 30; *Washington:* Buckley, July 6; Republic, August 5; Wenatchee, June 26; Pullman, July 2, 3; Puyallup, June 29, July 5; Sumner, October 20; Northwest of Yakima, June 19; *Oregon:* Yoncalla, July 12; Hood River, August 20; Gresham, September 12; Tillanook, October 15; Gilliam County, 30 Mile Creek, June 24; Freewater, August 23; Corvallis, October; LaGrenda, September 11; Jacksonville; Ashland; Waldport, October 22; Rogue River, September; Grant's Pass, September; West of Junction City, October; North of Cobury, October; South of Peoria, October; North of Kirby, September; North of Gold Hill, September; Lancaster, October; Azalea, September, October; Brentwood, August 25; Astoria, August 1; Portland, August, October; Salem, October 21; *California:* San Jacinto Mountains, July 21; Mountain View, September 21, 24; San Francisco, July 25; Quincy, July 23; *Sweden:* Rystad, Frosta, June 20; *Germany:* Bornkagen, Eichsfeld, October 8; *Poland:* Warsaw, June.

Determination of this species is based on figures by Ribaut (1936).

Edwardsiana lethierryi (Edwards)

(Pl. LXXXIX, fig. 1)

Typhlocyba lethierryi Edwards, Ent. Monthly Mag., vol. 17, 1881, p. 224.
Anomia lethierryi, Edwards, Ent. Monthly Mag., vol. 64, 1928, p. 82.
Edwardsiana lethierryi, China, Ent. Monthly Mag., vol. 86, 1950, p. 248.

Resembling *E. hippocastana* (Edwards) (1888), and *E. bergmani* Tullgren, but differs from the former in not having the dorsal branch of mesal pair of processes on aedeagus rebranching, and differs from the latter by having the mesal pair of processes branching nearly from the base.

Length.—3.5-3.75 mm.

Color.—Dorsum yellowish-white to yellow, without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin strongly convex, dorsal protuberance small, ventral angle a large smoothly rounded lobe.

Internal male genitalia.—Aedeagus with shaft slender, elongate, curving dorsocephalad, with two pairs of branching apical processes, lateral pair directed dorsolaterad to fork, dorsal branch shorter than ventral branch and directed dorsad, ventral branch directed ventrolaterad; median pair of processes branching near base, dorsolateral branch one third length of ventral branch.

A large series of male specimens has been collected by the author from *Acer platanoides,* in Milwaukee, Wisconsin.

Specimens have been seen from the following localities: *Nova Scotia:* Truro, August 17; *Massachusetts:* Cambridge, October 13, 20, 24; *New Hampshire:* Durham, September 9; *New York:* Salem, June 26, New York City, June 29, 1900; *Quebec:* St. Anne's, September 2; *Wisconsin:* Milwaukee, June 26, 27, 29; *England:* Cambridge, October 17.

Determination of this species is based on figures by Ribaut (1936).

Edwardsiana bergmani var. *bergmani* (Tullgren)

(Pl. LXXXIX, fig. 4)

Typhlocyba bergmani Tullgren, Ent. Tidskr., vol. 37, 1916, pp. 65-69.
Anomia bergmani, Edwards, Ent. Monthly Mag., vol. 64, 1928, p. 82.
Edwardsiana bergmani, China, Ent. Monthly Mag., vol. 86, 1950 p. 248.

Resembling *E. lethierryi* externally and in shape of aedeagus, but distinguished by having mesal pair of apical processes of the aedeagus branching near middle rather than near base, and by having a broad dorsal process on pygofer.

Length.—3.75 mm.

Color.—Dorsum light yellow without dark markings.

Genital capsule.—Male pygofer in lateral aspect, with posterior margin rounded on lower two thirds, deeply excavated on dorsal third, dorsal angle directed dorsad as a broad triangular, apically rounded process, ventral angle forming a slight lobe.

Internal male genitalia.—Aedeagus, with both pairs of apical shaft processes branching, lateral pair with branches of nearly equal length, directed dorsad, apices slightly curving toward each other; mesal pair of processes branching near middle, both branches slightly concave on dorsal surface, directed cephalad, ventral branches with apices converging mesad; aedeagal shaft strongly convex on posterior margin, recurved near apex, anterior margin more strongly recurved than posterior, width nearly uniform from base to apex in lateral aspect.

Only a single specimen of this variety from Arvidajaur, Sweden, September 20, in the collection of Dr. Frej Ossiannilsson of Uppsala, Sweden, has been seen. Illustrations for this variety have been made from this specimen to show how it differs from the following variety.

Edwardsiana bergmani var. *ariadne* (McAtee)

(Pl. LXXXIX, fig. 3)

Typhlocyba ariadne McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 14-15.

Length.—4.0-4.25 mm. (Alaska and Montana specimens).
3.75 mm. (Oregon specimens).
3.50 mm. (Michigan, Pennsylvania and Maine specimens).

Color.—Light yellow to light yellow-orange, disc of pronotum and fore wings deeper yellow.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin rounded on lower two thirds, dorsal angle as in type variety, ventral lobe more pronounced on specimens from Michigan, Pennsylvania, and Maine.

Internal male genitalia.—Aedeagus similar to that of type variety but with shaft strongly convex on both anterior and posterior margins, broader on apical two thirds and apex not recurved, length of apical processes proportionately longer on specimens from Alaska, Montana, and Oregon, lateral processes directed strongly laterad, length of processes on specimens from Michigan, Pennsylvania, and Maine nearly of the same proportion as those of the specimen of the

type variety but with shaft distinctly characteristic of that of the holotype of variety *ariadne,* from Vancouver, British Columbia.

The type of variability shown by this species is like that found between *Edwardsiana australis* Froggatt and *E. crataegi* (Edwards), still regarded as distinct species. Because of the scarcity of male specimens, the limited number of localities from which specimens have been collected, and the wide distribution of the species, the author has considered it best to regard *ariadne* as a variety of *bergmani* until conclusive evidence can be seen for regarding it as a distinct species.

Specimens have been seen from the following localities: *Alaska:* Ft. Yukon, July 15; Matanuska, July 12, 19, 21, 27, 28, August 17, September 24, 27, 28, October 2, 5, 6; Northeast of Anchorage, August 4; Sleese Highway, September 4; Anchorage, July 20; North of Paxton's Lodge 27-52 miles, July 28; *British Columbia:* Hope, August 1; Vancouver; Kalso, July 13, 17, June 22; *Oregon:* Mount Hood, July 3; Bonnville, July 4; Tillamook, October 15; *Washington:* Shelton, July 24; Sumner, August 20, September 18; Kalama, July 21; Conway, July 28; Quinault, July 26; *Montana:* Haugan, August 9; *Michigan:* Au Train, August 21; *Pennsylvania:* Hartstown Bog, September 13; *Maine:* Dixfield, October 20.

Types.—Holotype male, allotype female, and paratypes in the U. S. National Museum Collection; paratypes in the collection of W. Downes.

Edwardsiana expanda (DeLong and Johnson) (*new combination*)

(Pl. XC, fig. 1)

Typhlocyba expanda DeLong and Johnson, Ent. News, vol. 47, no. 4, April, 1936, p. 104.

Resembling *E. bergmani* var. *ariadne* in external appearance, but distinguished by having aedeagus with lateral pair of apical processes unbranched and strongly recurved laterodorsad.

Length.—4.0-4.5 mm.

Color.—White to light yellow without dark markings.

Genital capsule.—Male pygofer in lateral aspect very similar to that of *E. lethierryi,* but with ventral lobe more pronounced.

Internal male genitalia.—Aedeagus with lateral pair of apical processes unbranched, elongate, longer than mesal pair, closely appressed to shaft on basal fourth and directed dorsad, apical three fourths sharply recurved laterodorsad; mesal pair of processes directed laterocephalad branching near middle, dorsal branch slightly

longer than ventral branch, branches diverging from base and slightly curving toward each other at apices in lateral aspect.

Two abnormal specimens of this species which have the lateral processes shorter than usual and not recurved, have been seen, and superficially resemble the illustration of *Edwardsiana kemneri* Ossiannilsson, but are distinguished by having the mesal pair of processes like those of typical specimens of *E. expanda.* (see Plate XC, fig. 1d).

Specimens have been seen from the following localities: *Alaska:* Ft. Yukon, July 15; North of Paxton's Lodge 27-52 miles, July 28; *Northwest Territories:* Good Hope, August 23; *Oregon:* Hood, August 22; *California:* Siskiyou Mountains, June 24; *Colorado:* Cameron Pass, June 24; Estes Park, August 21, 25.

Types.—Holotype male, allotype female, and female paratype, in the collection of Dr. D. M. DeLong, Columbus, Ohio.

Edwardsiana frustrator (Edwards)

(Pl. XC, fig. 2)

Typhlocyba frustrator Edwards, Ent. Monthly Mag., vol. 44, 1908, p. 84.
Anomia frustrator, Edwards, Ent. Monthly Mag., vol. 64, April, 1928, p. 82.
Typhlocyba solearis Ribaut, Bull. Soc. Hist. Nat. Toulouse, vol. 61, pt. 1, 1931, p. 339.
Edwardsiana frustrator, China, Ent. Monthly Mag., vol. 86, 1950, p. 248.

Resembling *E. prunicola* in the shape of the aedeagus, but distinguished from it by having mesal pair of apical processes with branches as long as unbranched portion, and aedeagal shaft more slender and nearly straight.

Length.—3.5 mm.

Color.—Pale yellowish white to light yellow without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with dorsal angle smoothly rounded, ventral angle slightly angular and rounded apically.

Internal male genitalia.—Aedeagus with shaft slender, elongate, nearly straight, directed dorsad, lateral pair of apical processes unbranched, slightly concave on dorsal surface, directed cephalad for half the length of mesal pair, mesal pair of apical processes branching near middle, directed cephalad, with dorsal branch convex on dorsal surface and with ventral branch slightly concave on dorsal surface, branches less divergent than in *E. expanda.*

This species has not previously been recorded from North America and has recently been introduced from Europe, where it has been found on "nut bushes" and on "sycamore" according to China

(1943). Specimens seen have been taken on *Corylus*. Specimens have been seen from the following localities: *Washington:* Shelton, July 24, 1949; *Oregon:* McMinnville, August 22, 1946; Salem, September 29, 1947; Portland, October, 1948; Wheatlend, October 15, 1949; Orleans, October, 1949; West of Junction City, October, 1949; North of Coburg, October, 1949; Clackomas, October, 1950; *Sweden:* Linkoping, July 7, 1935 on *Acer platanus*.

Determination of this species is made on the basis of figures of the male genitalia of *Typhlocyba solearis* by Ribaut (1931b, 1936), reprinted by China (1943) as representative of the type of *T. frustrator* Edwards.

Edwardsiana plebeja (Edwards)

(Pl. XC, fig. 3)

Typhlocyba plebeja Edwards, Ent. Monthly Mag., vol. 50, 1914, pp. 168, 172.
Anomia plebeja, Edwards, Ent. Monthly Mag., vol. 64, April, 1928, p. 82.
Typhlocyba divergens Ribaut, Bull. Soc. Hist. Nat. Toulouse, vol. 61, pt. 1, 1931, pp. 339-341.
Edwardsiana plebeja, China, Ent. Monthly Mag., vol. 86, 1950, p. 248.

Resembling *E. prunicola* in external appearance and in male genitalia, but differing in having dorsal branch of mesal pair of aedeagal processes curving strongly dorsad, and by having margins of pygofer forming nearly a semicircle in lateral aspect.

Length.—3.25-3.75 mm.

Color.—Yellowish-white to light yellow without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin outlining a semicircle from base of anal tube to middle of ventral lobe, dorsal and ventral angles reduced.

Internal male genitalia.—Aedeagus with shaft evenly convex on posterior margin from base of preatrial shaft to apex, gradually reduced toward apex, lateral pair of apical processes unbranched, short, one third as long as mesal pair and directed dorsolaterad, mesal pair of apical processes branching at basal fourth, dorsal margins of both branches concave, dorsal branch broad in lateral aspect and strongly curving dorsad, ventral branch shorter and directed ventrocephalad.

A large series of specimens including nymphs labeled *Ulmus americana,* and several specimens labeled "Weeping Elm" have been seen.

Specimens have been seen from the following localities: *Massachusetts:* Wood's Hole, July 9, 1900; Cambridge; *New York:* September 1, 1919 (a series of 18 specimens made paratypes of *T. commissuralis* var. *munda* McAtee); *Washington D. C.:* May 24, 26;

Virginia: Arlington, October 2. Mrs. J. N. Knull informs me she has specimens of this species taken in Ohio.

This species has not previously been recorded as occurring in North America, although the first specimens were collected in 1900.

Determination of specimens is based on the figures of the male genitalia of *Typhlocyba divergens* Ribaut, (1931b, 1936), reprinted by China (1943) as representative of the type of *T. plebeja* Edwards.

Edwardsiana prunicola (Edwards)

(Pl. XC, fig. 4)

Typhlocyba prunicola Edwards, Ent. Monthly Mag., vol. 50, 1914, pp. 168, 172.
Anomia prunicola, Edwards, Ent. Monthly Mag., vol. 64, April, 1928, p. 82.
Typhlocyba barbata Ribaut, Bull. Soc. Hist. Nat. Toulouse, vol. 61, pt. 1, 1931, pp. 338-339.
Typhlocyba pruni DeLong and Davidson, Ohio J. Sci., vol. 34, no. 3, 1934, pp. 161-162, figs. 1-3.
Typhlocyba pruniella DeLong, Ohio J. Sci., vol. 44, no. 6, 1944, p. 272. (n. n. for *pruni* DeLong and Davidson, nec. *pruni* Edwards).
Edwardsiana prunicola, China, Ent. Monthly Mag., vol. 86, 1950, p. 248.

Resembling *E. plebeja* in outward appearance and in male genitalia, but distinguished by having median pair of apical processes of aedeagus branching near base, dorsal branch slender and longer than ventral branch, nearly straight and directed cephalad, and by having dorsal and ventral angles of pygofer produced.

Length.—3.75-4.0 mm.

Color.—Uniform light yellowish white to yellow without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with dorsal angle forming a rounded protuberance, ventral angle slightly produced forming nearly a right angle.

Internal male genitalia.—Aedeagus with lateral pair of apical processes unbranched and curving dorsocephalad and diverging laterally, mesal pair of apical processes branching near basal third, dorsal branch nearly straight, directed cephalad forming nearly a right angle with the axis of shaft, ventral branch directed ventrad toward base of aedeagal apodeme in lateral aspect, apices of both pairs of processes diverging laterad.

Specimens have been seen from the following localities: *New York:* Albany, August 17, 1900; *Utah:* Provo, September 17; Logan, June 26; Bountiful, June 20, July 2; *Idaho:* Boise, July 11; Parma, September 3; *Washington:* Puyallup, July 5; Yakima, August; *Oregon:* The Dalles; Milton, June 8; Dufur; Ashland; South of Peoria; *California:* Berkeley, May 15; San Jose, April 22; *Sweden:* August 14, "Prunus"; *Rumania:* Bucharest; *Bohemia.*

Determination of specimens is based on the figures of the male genitalia printed by China (1943). Specimens have been seen which have the pygofer rounded on ventral angle in addition to specimens similar to each of the drawings of the pygofer shown by China. The shape of the aedeagus is identical in specimens having variation in the shape of posterior margin of pygofer which seems to indicate that these forms are only degrees of variation within the species and insufficient as evidence for making *prunicola* and *barbata* distinct species.

Edwardsiana candidula (Kirschbaum)

(Pl. XC, fig. 5)

Typhlocyba candidula Kirschbaum, Jharb., Ver. Nat. Nassu., vol. 21-22, 1868, p. 185.
Anomia candidula, Edwards, Ent. Monthly Mag., vol. 64, April, 1928, p. 82.
Edwardsiana candidula, China, Ent. Monthly Mag., vol. 86, 1950, p. 248.

Resembling *E. expanda* in outward appearance and in shape of male genitalia, but distinguished by having lateral pair of processes on aedeagus directed dorsolaterad, not sharply recurved, apices of both branches of mesal pair of processes curving mesad.

Length.—3.5-3.75 mm.

Color.—Uniform milky-white without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with dorsal and ventral angles reduced, forming a single caudally directed, apically rounded lobe.

Internal male genitalia.—Aedeagus with shaft strongly convex on posterior margin, smoothly curving and evenly tapered to apex, lateral pair of apical processes unbranched, slender, directed dorsolaterad and appearing as a continuation of the shaft in lateral aspect, length equal to that of the mesal processes, mesal pair of processes of the aedeagus branching near base, branches slender, slightly diverging and curving laterocephalad outlining nearly a complete circle in cephalic aspect.

A large series of specimens of this species has been collected by the author from *Populus alba* in Milwaukee, Wisconsin. Specimens have been seen from the following localities: *Wisconsin:* Milwaukee, June 26-July 5; *Minnesota:* St. Paul, July 8, 11; *Oregon:* North of Coburg, October; *Germany:* Buchen, September 30, 1934, determined by W. Wagner.

Determination of specimens of this species has been based on figures of the male genitalia according to Ribaut (1936).

Edwardsiana australis (Froggatt) (*new combination*)

(Pl. XC, fig. 6)

Empoasca australis Froggatt, Agr. Gaz. New South Wales, vol. 29, 1918, pp. 568-571.
Typhlocyba australis, Myers, Proc. Linn. Soc. New South Wales, vol. 46, 1921, pp. 473-474.
Typhlocyba froggatti (Baker), Philippine J. Sci., vol. 27, 1925, p. 537. (nom. nov. for *australis* Froggatt, nec. *australis* Walsh 1862.)
Typhlocyba xanthippe McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 14.
Empoa (*Typhlocyba*) *malini* DeLong, J. Econ. Ent., vol. 19, no. 3, 1926, pp. 469-470.
Typhlocyba oxyacanthae Ribaut, Bull. Soc. Hist. Nat. Toulouse, vol. 61, pt. 1, 1931, pp. 334-335.
Edwardsiana froggatti, China, Ent. Monthly Mag., vol. 86, no. 1035, (4th ser. vol. XI, no. 128) 1950, pp. 243-248.

This species is not *Erythroneura australis* Walsh (1862), the synonymy of which is given on p. 1142.

Resembling *E. crataegi* in external appearance, and in male genitalia, but differing in having lateral pair of apical processes on aedeagus shorter, distinguished from other species by having a median unpaired process as well as two pairs of unpaired processes.

Length.—3.5-3.75 mm.

Color.—Dorsum yellow to orange-yellow; fore wings with fumose areas along commissural suture covering outer half of clavus, apices of inner three basal cells, and all of hyaline apical cells.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight, obliquely slanting ventrocaudad, dorsal posterior margin excavated and with a short projection arising on dorsal margin.

Internal male genitalia.—Aedeagus with shaft broad on basal half, apical half slender, with two pairs of unbranched apical processes and a single unpaired median process; lateral pair of apical processes shorter than mesal pair, curving laterodorsad and caudad; mesal pair of processes strongly concave on dorsal surface and curving dorsolaterad anteriorly; unpaired process arising between mesal pair of processes and strongly convex on dorsal margin curving dorsocephalad.

Several short series of specimens of this species were collected by the author in Milwaukee, Wisconsin, from: *Crataegus* sp., *Malus* sp., *Aesculus hippocastanum,* and *Prunus* sp.

Specimens have been seen from the following localities: *Massachusetts:* Lexington, June 19; Cambridge; Boston, June 23; *Connecticut:* New Haven, August 18, 20; Mystic, August 19; *New York:* New York City, June 22; *Ontario:* Vineland Station, September 2,

8, 13; *Ohio:* Wooster, July 5; Columbus, July; *Minnesota:* St. Paul, August 20; *Wisconsin:* Milwaukee, June 26-July 5; *Utah:* Castle Dale, August 27; *British Columbia:* Vancouver, August 4; *Washington:* Puyallup, July 5; *Oregon:* Portland, October; Neskowin, October 3; Clachomas, October 13; *California:* Sequel, June 7; *Chile:* Santiago Quinta Normal, December, 1946; El Pino Angol, February 27, March 24, 1932, on apple.

Although Mrs. J. N. Knull has informed me (in correspondence) that she has seen a specimen of *E. crataegi* among specimens of *E. froggatti* from Wooster, Ohio, the author has not seen any specimens of *crataegi* in the samples of this species examined. It is quite possible that this species is only a variety of *crataegi*, and if this is the case additional specimens of *crataegi* should be found in North America.

Determination of specimens of this species are based on figures of the male genitalia printed by W. E. China (1943).

Edwardsiana projecta sp. nov.

(Pl. XCI, fig. 1)

Resembling *E. candidula* in outward appearance, but easily distinguished by having mesal pair of processes on aedeagus one fourth the length of lateral processes, and fused on basal half, appearing as single branching median process.

Length.—3.5-4.0 mm.

Color.—Uniform milky-white without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight, slanting obliquely ventrocaudad, dorsal angle more prominent than in preceding species, ventral angle forming a broad, caudally protruding lobe.

Internal male genitalia.—Aedeagus very similar to that of *E. fratercula* (Edwards) but with mesal pair of apical processes unbranched; shaft proportionately short and stout as compared to other species, scarcely longer than aedeagal apodeme, apical half straight and only slightly reduced in diameter toward apex; lateral processes slender, widely diverging laterodorsad, posterior margin convex in lateral aspect; mesal processes straight, directed cephalodorsad, one fourth the length of lateral processes, fused on basal third and appearing as a single branched process, apical two thirds as long as broad.

Types.—Holotype male and three male paratypes, LaVeta Pass, Colorado, July 28, 1937, L. D. Tuthill, in the Iowa State College Collection.

Edwardsiana pseudocommissuralis sp. nov.

(Pl. XCI, fig. 2)

Resembling *E. commissuralis* in color markings, but with mesal pair of apical processes on aedeagus branching.

Length.—3.75-4.0 mm.

Color.—Head and pronotum yellow to yellow-orange; scutellum brown medially, outer angles yellow; fore wings yellow to yellow-orange, with black longitudinal band along commissural margin on outer half of clavus extending to cross veins, apices of basal and all of apical cells fumose-hyaline.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin strongly rounded, similar to pygofer in *E. plebeja.*

Internal male genitalia.—Aedeagus with shaft slender, slightly enlarged on basal half, posterior margin slightly angled near middle, with two pairs of apical processes; lateral pair of apical processes unbranched, exceeding mesal pair in length, directed dorsolaterad, sinuate on apical two thirds; mesal pair of apical processes fused on basal two thirds, with a pair of short straight branches arising at basal third, directed dorsocephalad parallel to each other, apical two thirds strongly curving laterodorsad anteriorly, apical third divided into two branches which diverge laterad.

Types.—Holotype male, Trinity Bay, Quebec, August 20, 1929, W. J. Brown, in the Canadian National Collection; allotype female and female paratype, Crawford Notch, New Hampshire, August 21, 1934, P. W. Oman, in the U. S. National Museum Collection.

Edwardsiana dejecta sp. nov.

(Pl. XCI, fig. 3)

Resembling *Typhlocyba putmani* in external appearance, but easily distinguished by the absence of atrial processes on the aedeagus, and by having mesal pair of apical processes unbranched and directed sharply ventrad from base.

Length.—4.0-4.5 mm.

Color.—Uniformly light yellowish-white to yellow without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight, dorsal angle slightly produced, ventral angle slightly angular.

Internal male genitalia.—Aedeagus with shaft elongate, slightly enlarged on basal two thirds, reduced on outer third and slightly sinuate, with two pairs of unbranched apical processes on aedeagus,

lateral pair half as long as mesal pair, nearly straight, diverging laterodorsad anteriorly, mesal pair of apical processes sharply directed ventrad from base, broadly joined basally by a transverse plate, only slightly diverging and curving toward base of shaft.

A large series of specimens has been collected by the author from *Cornus stolonifera,* in Milwaukee, Wisconsin, in association with *Typhlocyba putmani,* a species almost identical with it in external appearance.

Types.—Holotype male and fifty-nine paratype males, Milwaukee, Wisconsin, July 1, 1950; allotype female and twenty-three female paratypes, July 3, 1950, Milwaukee, Wisconsin; one male paratype June 26, 1950, Milwaukee, Wisconsin; seven male paratypes, July 4, 1950, Milwaukee, Wisconsin, P. J. Christian; types in the Snow Entomological Collections of the University of Kansas; one male paratype, July 13, 1940, and two female paratypes, July 16, 1940, Vineland Station, Ontario, W. L. Putman, in the Canadian National Collection.

The Commissuralis Complex

The following six species compose a group which on the basis of male genitalia appear to be more closely related to each other than to other species in the genus.

Edwardsiana commissuralis (Stål) (*new combination*)

(Pl. XCI, fig. 3)

Typhlocyba commissuralis Stål, Stett. Ent. Zeit., vol. 19, 1858, p. 196. (Reprint by Gillette, 1898, Proc. U. S. Nat. Mus., vol. 20, pp. 769-770.)
Kybos commissuralis, Fieber, Verh. Zool.-bot. Ges. Wien., vol. 16, 1866, p. 508.
Empoasca commissuralis, Ashmead, Harriman Alaskan Exped., vol. 8, 1904, p. 135.
Empoa commissuralis, Van Duzee, Trans. San Diego Soc. Nat. Hist., vol. 2, no. 1, 1914, p. 57.
Typhlocyba commissuralis var. *munda* McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 12.

Resembling *E. pseudocommissuralis* in color markings, but with apical processes of aedeagus unbranched, lateral pair as long as or slightly shorter than median pair, pygofer with posterior margin oblique and with ventral angle smoothly rounded.

Length.—3.0-4.5 mm.

Color.—Head, pronotum, and lighter portions of fore wing light yellowish-white to orange-yellow; scutellum and commissural margin of fore wings usually dark black, width of black on wing varies from a narrow line to two-thirds the width of clavus, apical cells fumose, heavily pigmented specimens with dorsal surface of head near base, pronotum, apical half of clavus, and basal fourth

of costal margin dark black, lighter portions deep yellow and apical cells strongly fumose; abdomen yellow, margin of each segment of dorsum black, pygofer with heavily sclerotized portions black.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin evenly rounded from base of anal tube to ventral angle, slightly produced as a broad ventrally directed lobe.

Internal male genitalia.—Aedeagus slender, gradually tapering to apex, curving cephalad from base, with two pairs of unbranched apical processes, processes slightly sinuate, the lateral pair directed dorsocephalad diverging laterad and continuing in the same axis as the shaft in lateral aspect, mesal pair of processes directed ventrocephalad and diverging laterad.

The host plants known for this species are *Alnus viridis* and *A. rhombifolia.* A series of specimens is also on hand collected on "flowering dogwood".

Specimens have been seen from the following localities: *Alaska:* Fairbanks, July 24, 28; Valdez, August 24; Matanuska, July 21; *Northwest Territories*: Aklavik, July 18; *British Columbia:* Vancouver, August 4, 8, September 3; Saanich District, September 12; Gorgon Head, September 12; Victoria, November 11; *Washington:* Buckley, July 6; Sumner, August 20; Puyallup, July 6; Shelton, July 24; *Oregon:* Rogue River, August 16; Lee's Camp, September 23; The Dalles, October 8; Scapoose, October 16; Mount Hood, July 3, 8; McMinnville, August 15, 19, 21; Tillamook, October 15; Pioneer, October 15; Booneville, July 4; Bend, July 2, 3; Dixie, July 8; North Powder, July 13; Pendleton, July 14; *California:* North of Cassel 5 miles, July 15; Muir Woods, September 5; Tahoe South Alpine Creek, July 15; Cucamonga, December 12; Eureka, July 23; Bray, June 30; Alameda County, July 19; Lemon Cove, July 24; Strawberry, August 8; Stinson Beach, August 15; Donner Lake, June 6; Colfax, June 23; *Wyoming:* Laramie, August 16; *Idaho:* Alturas Lake, July 19; *Utah:* Emery, August 16; *Colorado:* Pagosa Springs; Sloss, August 17; Durango, July 17.

Types.—Holotype male, Sitka, Alaska, (present location of type unknown).

Variety *munda,* holotype, allotype and paratypes, in the U. S. National Museum Collection. One paratype male, Vancouver, British Columbia, is a specimen of *E. bergmani* var. *ariadne,* and a series of paratypes from New York are specimens of *E. plebeja.* Some of the specimens of this variety are only teneral specimens, but others appear to be fully matured yet lack the dark markings of the type variety.

Specimens bearing a black commissural line, and occurring in Northeastern United States and Southeastern Canada, will probably be specimens of *E. pseudocommissuralis*. Specimens of *Ossiannilssonola phryne* may also be confused with it, but differ by having black parenthesis-shaped markings on the scutellum and pronotum, and a black spot in each of inner three basal cells.

Edwardsiana dorsti (Ossiannilsson) (*new combination*)

(Pl. XCI, fig. 4)

Typhlocyba dorsti Ossiannilsson, Ent. Tidskr., vol. 57, no. 1, 1936, pp. 10-11, figs. 1-3.
Typhlocyba enascora DeLong and Johnson, Ent. News, vol. 47, no. 4, April, 1936, pp. 103-104, figs. 1-6. (*new synonymy*).

Resembling *E. euphrante* in outward appearance and in proportion of apical processes of aedeagus, but differs in having posterior margin of pygofer smoothly rounded and without hook on ventral angle, and in having median pair of apical processes parallel to each other and strongly curving dorsocephalad on apical half.

Length.—3.5 mm.

Color.—Light yellowish-white to light yellow without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin forming a broadly rounded lobe, ventral angle slightly pointed.

Internal male genitalia.—Aedeagus with shaft slender, gradually reduced toward apex, with two pairs of unbranched apical processes, lateral pair straight and directed dorsolaterad, less than half as long as mesal pair, mesal pair of apical processes strongly curving dorsocephalad on apical half, fused at base and continuing nearly parallel to each other to apex.

Specimens from the following localities have been seen: *Idaho:* Idaho Falls, July 27; *Oregon:* Dufur; *Nevada:* Ormsby, July.

Types.—Holotype male, in the collection of Dr. Frej Ossiannilsson, Uppsala, Sweden. The aedeagus of the holotype has been lost since its description, but the original drawings are sufficiently clear to recognize it as the same species as the holotype of *Typhlocyba enascora*. The description of *dorsti* was mailed on February 2, 1936, while that of *enascora* was mailed April 12, 1936.

Edwardsiana nigripennis sp. nov.

(Pl. XCII, fig. 1)

Resembling *E. commissuralis* externally by having commissural vein black on basal two thirds and in its large size, but distinguished

by having median pair of apical processes strongly curving dorsocephalad and in having all of aedeagus but the apical third of shaft black rather than brown.

Length.—4.0 mm.

Color.—Light yellowish-white to yellow with commissural vein brown on basal two thirds.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight, obliquely slanting ventrocaudad, dorsal angle slightly produced to a point, ventral angle slightly produced caudally to a point.

Internal male genitalia.—Aedeagus with shaft slender, with two pairs of unbranched apical processes of nearly equal length, lateral pair of processes slender, directed dorsolaterad in the same axis as the shaft, median pair of processes strongly curving dorsolaterad from base, preatrial arm and basal two thirds of shaft black, apical third dark brown as in other species.

Types.—Holotype male, allotype female, four male and three female paratypes, Stinson Beach, California, August 15, 1938, R. H. Beamer, in the Snow Entomological Collections of the University of Kansas.

Edwardsiana delongi sp. nov.

(Pl. XCII, fig. 2)

Resembling *E. nigripennis* in shape of the aedeagus, and *E. euphrante* in the shape of the pygofer, distinguished from the first by having hook on ventral angle of pygofer, and from the second by having apical processes of aedeagus of nearly equal length.

Length.—3.25-3.5 mm.

Color.—Light yellowish-white to yellow without dark markings.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin nearly straight and slanting ventrocaudad, dorsal angle slightly produced, ventral angle with a short caudally directed hook.

Internal male genitalia.—Aedeagus with two pairs of unbranched apical processes, lateral pair directed strongly laterad on basal half and curving dorsocephalad on apical half, median pair of processes strongly curving dorsocephalad and only slightly distant from each other throughout their length.

Types.—Holotype male, allotype female, and one male paratype, Bray, California, June 30, 1935, R. H. Beamer, and one male paratype, Dixie, Oregon, July 8, 1939, R. H. Beamer, in the Snow Entomological Collections of the University of Kansas; twenty-four fe-

male and sixteen male paratypes, Bray, California, June 30, 1935, P. W. Oman, and eight female and four male paratypes, Kalama, Washington, July 4, 1935, P. W. Oman, in the U. S. National Museum Collection; one male, Grant's Pass, Oregon, September, 1949, S. M. Dietz, in the Oregon State Department of Agriculture Collection, Salem, Oregon; two males and one female paratype, south of San Francisco, California, October 2, 1915, O. E. Essig, on Wild Blackberry, in the University of California Collection; some paratypes from Washington, Oregon, and S. of San Francisco, differ in having the ventral hook of the pygofer reduced.

Edwardsiana ariste (McAtee) (*new combination*)

(Pl. XCII, fig. 4)

Typhlocyba ariste McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, p. 13.

Resembling *E. australis* (Froggatt) in size and color markings, and *E. commissuralis* in form of male genitalia, differing by having only two pairs of apical processes on aedeagus and in having the lateral pair exceeding the median pair by one fourth.

Length.—3.5-3.75 mm.

Color.—Yellowish-white to slightly greenish-yellow or yellow, with fumose spots in apices of basal and all of apical cells, slightly fumose along commissural margin.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin convex, with ventral angle slightly produced caudad as a small apically rounded lobe.

Internal male genitalia.—Aedeagus slender on distal half, with two pairs of unbranched apical processes, lateral pair of processes one-fourth longer than median pair, slender and widely diverging laterodorsad appearing as a continuation of apex of shaft in lateral aspect, median pair of processes slender and straight, diverging laterocephalad.

This species occurs on *Ribes.* Specimens have been seen from the following localities: *New Mexico:* Pecos, September 1; *Colorado:* Creede, July 2, 3, 16; Estes Park, July 18, August 25; Ft. Collins, July 19.

Types.—Holotype male, in the U. S. National Museum Collection; female, Creede, Colorado, July 16, 1938, L. D. Tuthill, collected with males of this species, here designated *neoallotype,* in the Iowa State College Collection.

Edwardsiana euphrante (McAtee) (*new combination*)

(Pl. XCII, fig. 5)

Typhlocyba euphrante McAtee, Proc. U. S. Nat. Mus., vol. 68, art. 18, 1926, pp. 12-13.

Resembling *E. ariste* in external appearance and in form of the male genitalia, but distinguished by having lateral pair of apical processes of aedeagus one third length of median pair and by having ventral hook on pygofer produced to an acute apex.

Length.—3.5 mm.

Color.—Yellowish-white to dark yellow, fore wings sometimes light greenish-yellow, apical and apices of basal cells slightly fumose.

Genital capsule.—Male pygofer, in lateral aspect, with posterior margin slightly convex, slanting ventrocaudad, dorsal angle not produced, ventral angle with a short, acute caudally directed hook.

Internal male genitalia.—Aedeagus with shaft broad on basal two thirds and reduced on apical third, with two pairs of unbranched apical processes, lateral pair straight, one third length of median pair, directed laterodorsad, median pair straight, directed laterocephalad.

Specimens labeled "wild currant" have been seen. No other host plant records are known.

Specimens have been seen from the following localities: *British Columbia:* Vancouver, August 8; Hope, August 1; *Washington:* South of Cheney, July 9; Kalama, July 4; *Oregon:* South of Bend, July 2; Bend, July 2; Galena Summit, June 3; *California:* Clear Lake, July 21; *Idaho:* Craters of the Moon, June 29; *Utah:* Fish Lake, August 16; Soldier, August 13, (*type series*); Soldier Summit, August 13; *Colorado:* Kremmling, July 17. A single male specimen from 2 miles west of St. Louis, Missouri, is very similar to specimens of this species, but lacks the ventral hook on the pygofer.

Types.—Holotype male, allotype female, and two male paratypes, in the U. S. National Museum.

Discussion of the Commissuralis Complex

Although the preceding six species have been described as sharply distinct species, intermediate forms have been found to occur. Two large series of specimens have been seen which are morphologically intermediate between *E. ariste* and *E. euphrante*. *E. ariste* is characterized as having the lateral pair of apical processes of the aedeagus one-fourth longer than the median pair, and having the posterior margin of the pygofer strongly convex with a short rounded apical lobe. *E. euphrante* is characterized as having

the lateral pair of apical processes of the aedeagus one third as long as the median pair, and having the posterior margin of the pygofer strongly convex with the ventral angle strongly produced caudally as a short acute hook.

Two large series of specimens have been seen which are intermediate between these two species. One of these series taken on *Ribes inebrians,* near Flagstaff, Arizona, is close to *E. ariste,* and has both pairs of apical processes of the aedeagus of nearly equal length, the posterior margin of the pygofer is convex in the majority of specimens with the ventral angle only slightly lobed and apically rounded. Some specimens which appear to be subnormal have the posterior margin of the pygofer straight and nearly vertical. The second series of specimens is intermediate between the preceding series and *E. euphrante,* having the lateral pair of apical processes of the aedeagus only one half as long as the median pair, and having the ventral lobe of the pygofer only slightly lobed and apically rounded. This series was taken on *Ribes* sp. near Hot Sulfur Springs, Colorado.

E. dorsti is another species which does not differ from the preceding two species and their intermediates in external appearance, but differs only in that the pygofer is broadly rounded on the ventral lobe, and that the apical processes of the aedeagus which are of the same proportionate length as those found on *E. euphrante* have the median pair strongly curving dorsocephalad on the apical third. The author has seen only four specimens of this species so that the interspecific variability is not known.

Some specimens of a fourth species, *E. commissuralis* are also very similar to the preceding species in size, and differ from the series of specimens from Flagstaff, Arizona, only in the presence of the commissural black stripe on the fore wings, and in the shape of the ventral lobe of the pygofer which is broadly rounded apically and does not form a small ventral lobe. The great difference in the size of specimens from different localities (3.0-4.5 mm.) and in the relative amounts of black color composing the wing markings indicates the degree of external variability which one of these species may show, although on the basis of the shape of the male genitalia this constitutes only one species.

The larger specimens of *E. commissuralis* are similar to *E. nigripennis* in size and the narrow dark line along the commissural margin in *nigripennis* strengthens the similarity although the genitalia are easily recognized as those of distinctly different species.

The sixth species in this complex, *E. delongi,* strongly resembles

E. euphrante in the shape of the posterior margin of the pygofer, but its greater length, and the size, relative lengths, and shape of the aedeagal processes set it off from *euphrante* as a distinct species.

A number of abnormal specimens, some taken singly, others in association with normal specimens have been seen. Some of these showed evidences of the presence of internal parasites while in others no evidences of the parasitism could be seen. Many of these specimens were intermediate in structure of the aedeagus and pygofer so that the species to which they belonged could not be determined. Although some of the specimens in the two large series of intermediate forms mentioned in relation to *E. ariste* and *E. euphrante* were apparently abnormal in structure, sufficient numbers of apparently normal specimens were on hand to indicate that something other than parasitism must account for so many specimens having the same degree of modification.

Whether this complex of species represents the extremes of variation of one or two species, or whether each of these is a distinct species cannot be conclusively decided from the evidence that is on hand. Only by the collection of numerous samples of specimens throughout the range of these species will it be possible to determine the relationships between these species.

GLOSSARY OF TERMS

aedeagus.—The sclerotized intromittent organ of the male, composed of base, dorsal apodeme, preatrial arm, shaft, and atrial processes, though some of these may be absent.

aedeagal apodeme.—A dorsal arm arising from the base of the aedeagus, for muscle attachment.

alveolus.—A socket in the cuticula for a seta, vestigial on inner margin of styles.

apical processes.—Processes arising from the shaft of the aedeagus at, or distad of outer third.

atrial processes.—Paired processes arising from the base of the aedeagus ventrad or laterad of the atrium, rarely fused with shaft and thus becoming shaft processes.

atrium.—A large opening in the base of aedeagus through which the gonoduct passes to the base of the shaft.

apical cells.—Areas of the wings distad of cross veins, marked off by apical veins, numbered outward from mesal or caudal margin of the wing.

basal cells.—Areas of the wings basad of cross veins, marked off by longitudinal veins, numbered from the mesal, or caudal margin, outward.

base of aedeagus.—Part of aedeagus to which shaft, atrial processes, aedeagal apodeme, and preatrial arm are attached, sometimes massive, sometimes reduced and indistinct.

brachial cell.—First basal cell of fore wing, lying along claval suture.

connective.—A ventrally located plate with styles attached laterally, and aedeagus attached posteriorly.

dorsal angle.—Portion of pygofer bordering on dorsal half of caudal margin, and caudal half of dorsal margin.

genital capsule.—Ninth abdominal segment, composed of pygofer and plates.

gonopore.—Distal opening of gonoduct.

internal male genitalia.—Composed of aedeagus, connective, and styles.

macrosetae.—Large setae with diameter several times that of microsetae, with large lumen, arising from alveolus.

microsetae.—Filiform setae, short or greatly elongate, lumen small or indistinct, arising from alveolus.

plate.—An elongate lobe arising from the venter of the genital capsule of the male, functioning as a clasping organ.

preatrial arm.—Ventral arm of aedeagus extending cephalad from ventral margin of atrium.

process.—A cuticular projection sometimes elongate, slender, heavily sclerotized (on aedeagus); sometimes a modified lobe of cuticula terminating as a hook or spine (on pygofer, style, or plate).

pygofer.—Side of genital capsule.

pygofer hooks.—Projections from dorsal, posterior, or ventral margins of pygofer, strongly sclerotized or not, apex acutely pointed.

shaft.—Usually a sclerotized tubular portion of aedeagus through which the gonoduct passes; in the genus *Ossiannilssonola* reduced to a membranous structure between atrial processes.

shaft processes.—Processes arising from shaft of aedeagus, usually paired.

spine.—A heavily sclerotized, acute, cuticular appendage, not articulate.

style.—One of the paired clasping organs comprising the inner male genitalia.

Typhlocyba Complex.—Those genera of leafhoppers which have two apical cells open in the hind wing, and have the fore wing with first apical cell not reaching the apex of the wing, and third apical cell usually triangular and stalked.

ventral angle.—Portion of pygofer bordering on ventral half of caudal margin, and caudal half of ventral margin.

ventral lobe.—Lobe of pygofer just dorsad of outer basal angle of male plate.

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INDEX TO GENERA AND SPECIES

PLATE LXXIII

FIG. 1. *Henribautia nigricephala* (Beamer)
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.
- 1f. Left plate, ventral aspect.
- 1g. Left plate, left lateral aspect.
- 1h. Left fore and hind wing.
- 1i. Head of male and female, dorsal aspect.

FIG. 2. *Henribautia beameri* sp. nov.
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.

FIG. 3. *Henribautia hubbardi* (McAtee)
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.

FIG. 4. *Mcateeana sexnotata* (Van Duzee)
- 4a. Left side of pygofer and left plate, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.
- 4d. Aedeagus, dorsal aspect.
- 4e. Right style, ventral aspect.
- 4f. Connective, ventral aspect.
- 4g. Left plate, ventral aspect.
- 4h. Left fore and hind wing.
- 4i. Head of male and female, dorsal aspect.

PLATE LXXIII

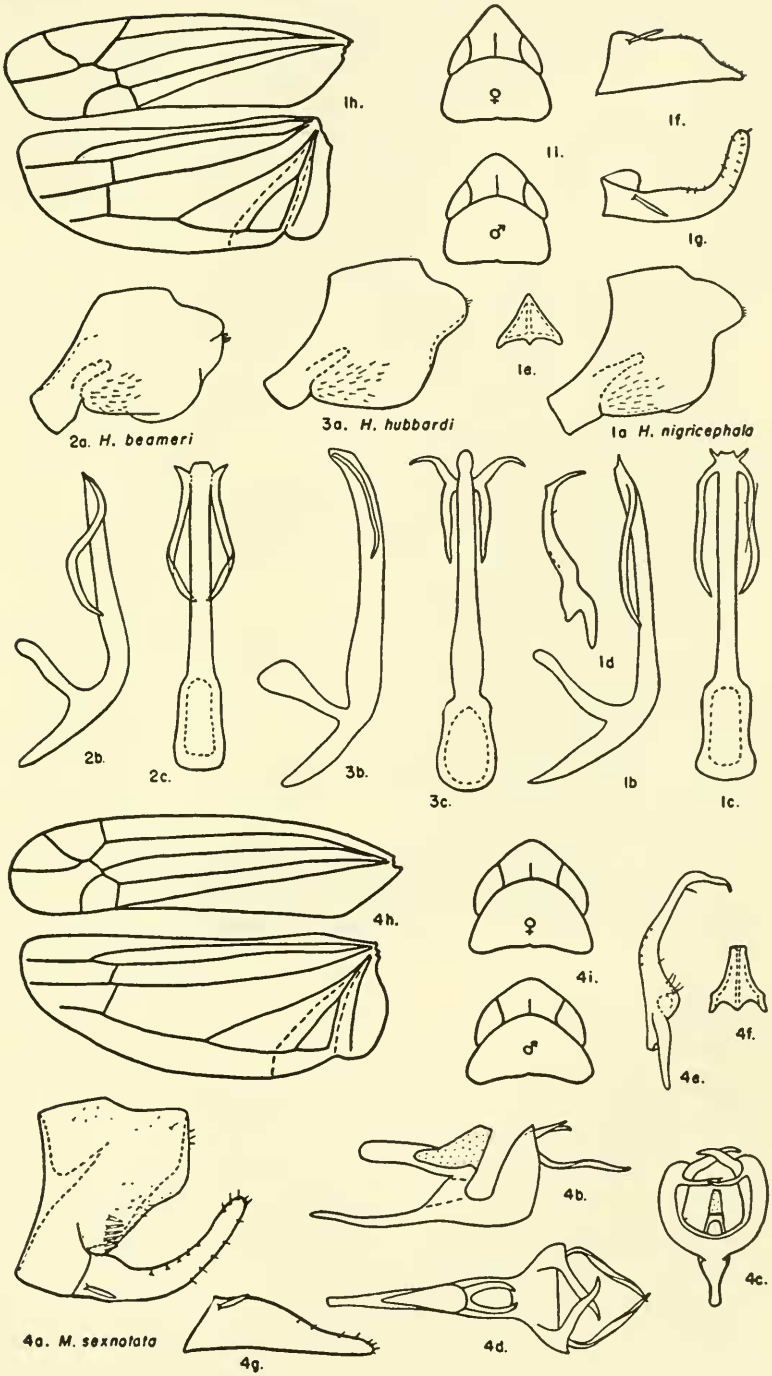

PLATE LXXIV

FIG. 1. *Ribautiana ulmi* (Linnaeus)
- 1a. Left side of pygofer and left plate, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.
- 1f. Left plate, ventral aspect.
- 1g. Left fore and hind wing.
- 1h. Head of male and female, dorsal aspect.

FIG. 2. *Ribautiana tenerrima* (Herrich-Schäffer)
- 2a. Pygofer, left side, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.

FIG. 3. *Ribautiana parapiscator* sp. nov.
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.

FIG. 4. *Ribautiana unca* (McAtee)
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.
- 4d. Tip of aedeagus, left lateral aspect. Oregon specimen.
- 4e. Tip of aedeagus, left lateral aspect. California specimen.
- 4f. Tip of aedeagus, left lateral aspect. Missouri specimen.
- 4g. Tip of aedeagus, left lateral aspect. Colorado specimen.

PLATE LXXIV

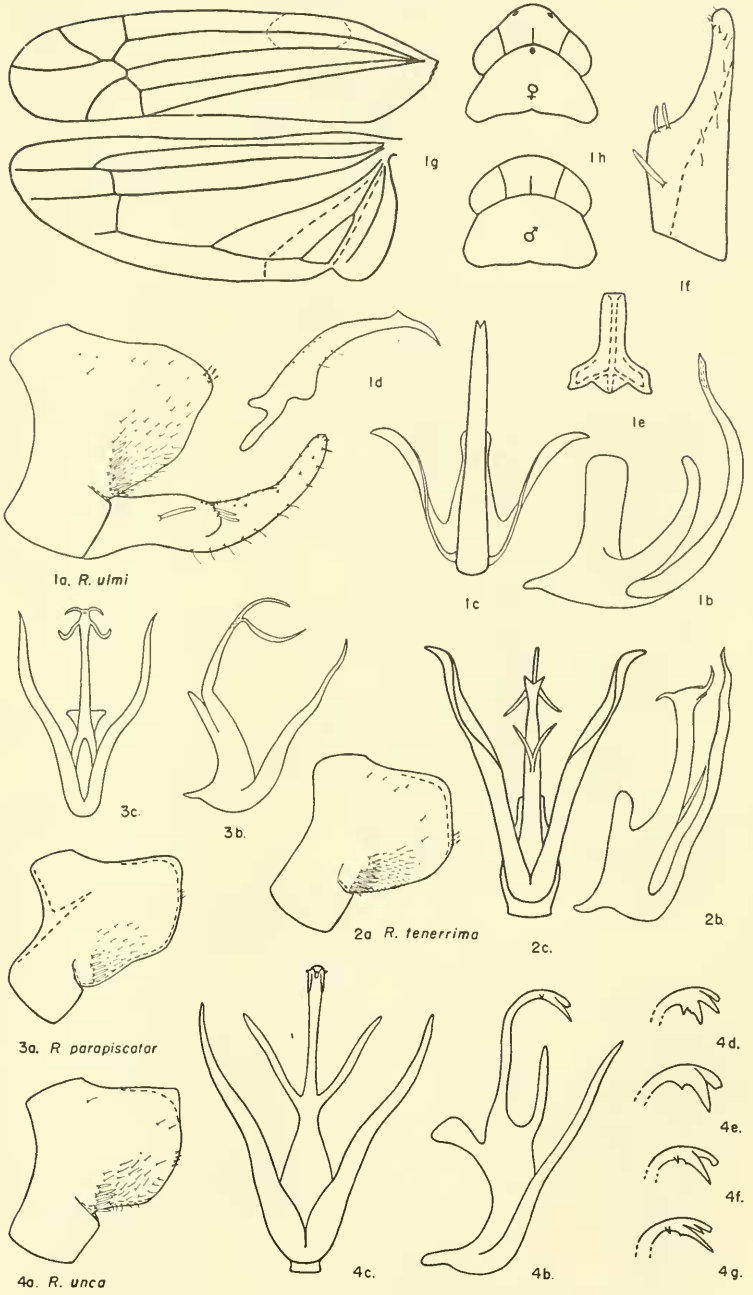
1g
♀
1h
♂
1f
1d
1e
1a. R. ulmi
1c
1b
3c.
3b.
2a R. tenerrima
2c.
2b.
3a. R parapiscator
4a. R. unca
4c.
4b.
4d.
4e.
4f.
4g.

PLATE LXXV

FIG. 1. *Ribautiana luculla* (Medler)
1a. Left side of pygofer, lateral aspect.
1b. Aedeagus, left lateral aspect.
1c. Aedeagus, posterior aspect.
FIG. 2. *Ribautiana foliosa* (Knull)
2a. Left side of pygofer, lateral aspect.
2b. Aedeagus, left lateral aspect.
2c. Aedeagus, posterior aspect.
FIG. 3. *Ribautiana piscator* (McAtee)
3a. Left side of pygofer, lateral aspect.
3b. Aedeagus, left lateral aspect.
3c. Aedeagus, posterior aspect.
FIG. 4. *Ribautiana multispinosa* sp. nov.
4a. Left side of pygofer, lateral aspect.
4b. Aedeagus, left lateral aspect.
4c. Aedeagus, posterior aspect.
FIG. 5. *Ribautiana sciotoensis* (Knull)
5a. Aedeagus, left lateral aspect.
5b. Aedeagus, posterior aspect.

PLATE LXXV

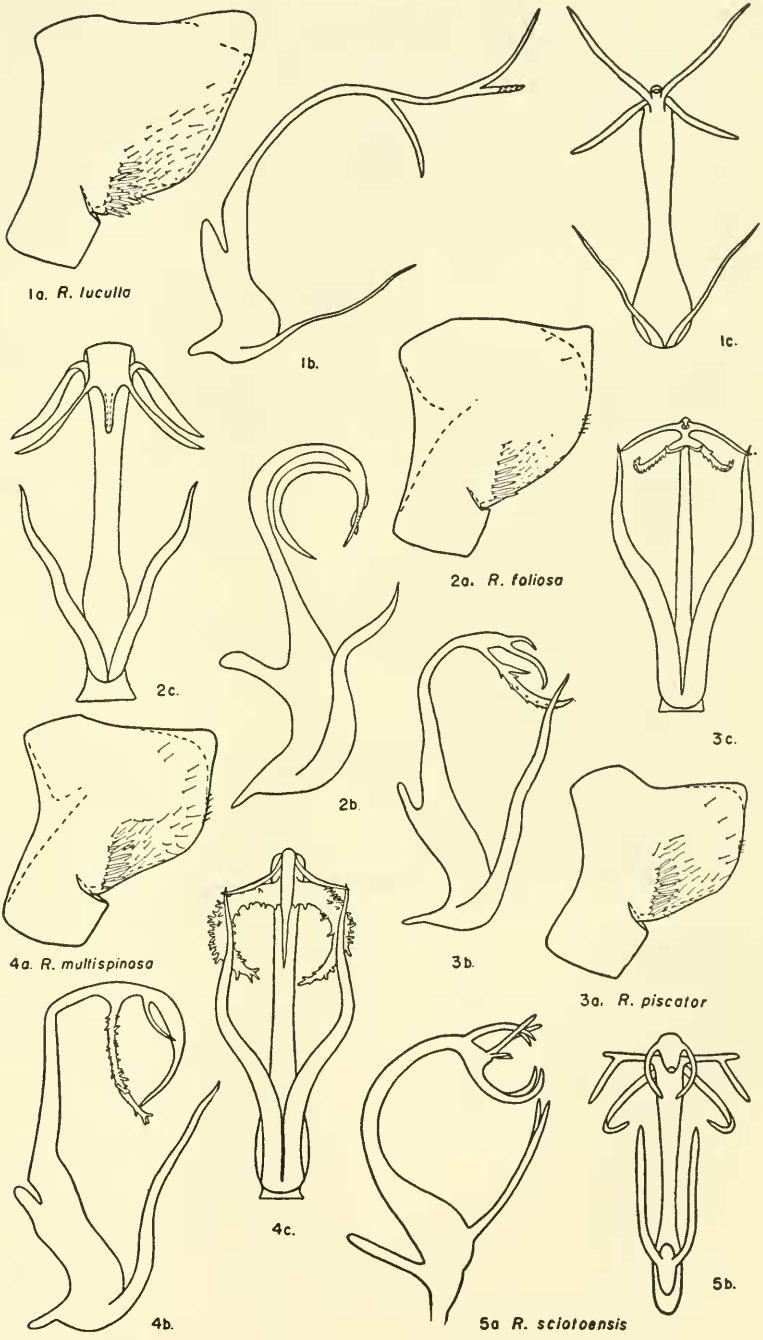
1a. R. luculla
1b.
1c.
2a. R. foliosa
2c.
2b.
3c.
3b.
3a. R. piscator
4a. R. multispinosa
4c.
4b.
5a R. sciotoensis
5b.

PLATE LXXVI

FIG. 1. *Ossiannilssonola berenice* (McAtee)
- 1a. Left side of pygofer and left plate, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.
- 1f. Left plate, ventral aspect.
- 1g. Left fore and hind wing.
- 1h. Head of male and female, dorsal aspect.
- 1i. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 2. *Ossiannilssonola hermione* (McAtee)
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 3. *Ossiannilssonola volans* (McAtee)
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Left side of pygofer, dorsal angle, posterior aspect.

PLATE LXXVI

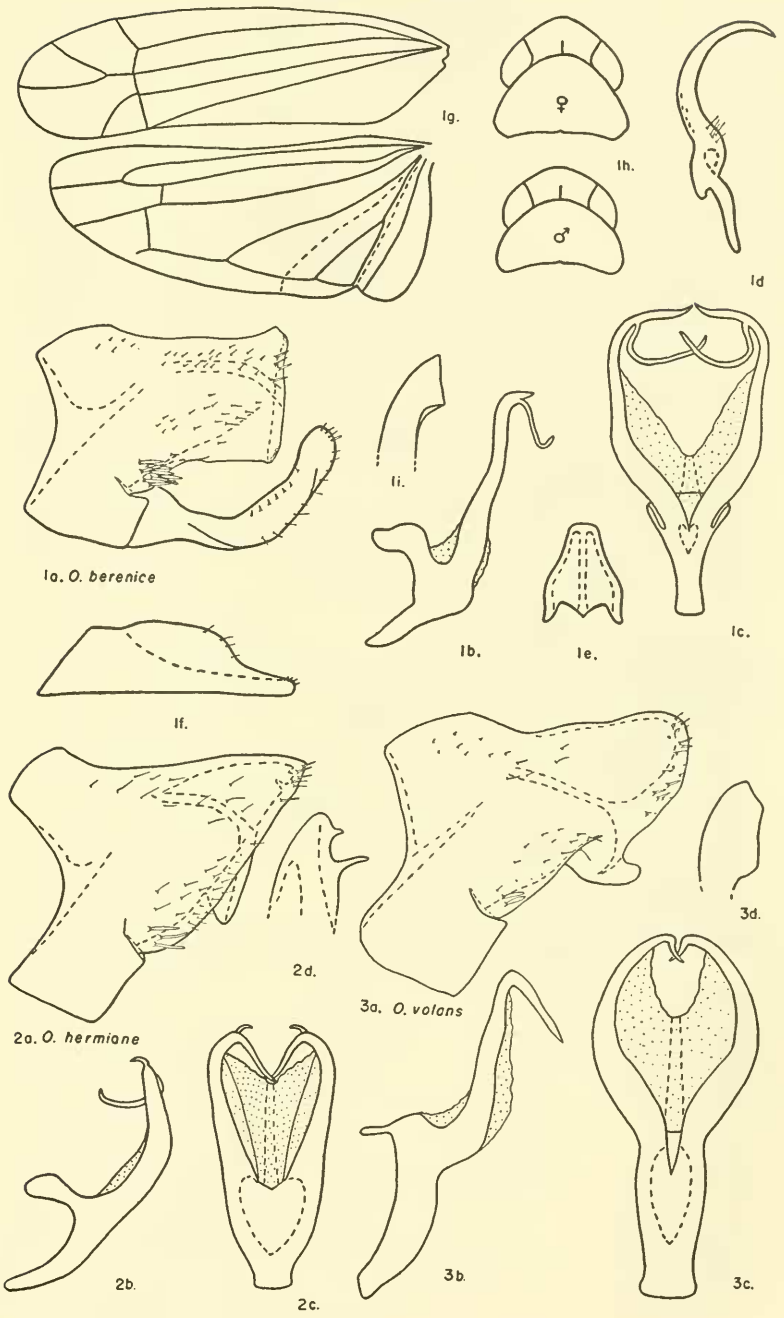
1g.
♀
1h.
♂
1d
1a. O. berenice
1i.
1b.
1e.
1c.
1f.
2d.
2a. O. hermiane
3a. O. volans
3d.
2b.
2c.
3b.
3c.

PLATE LXXVII

FIG. 1. *Ossiannilssonola antigone* (McAtee)
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 2. *Ossiannilssonola clymene* (McAtee)
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 3. *Ossiannilssonola tunicarubra* (Gillette)
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 4. *Ossiannilssonola australis* (Walsh)
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.
- 4d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 5. *Ossiannilssonola hinei* (Knull)
- 5a. Left side of pygofer, lateral aspect.
- 5b. Aedeagus, left lateral aspect.
- 5c. Aedeagus, posterior aspect.
- 5d. Left side of pygofer, dorsal angle, posterior aspect.

PLATE LXXVII

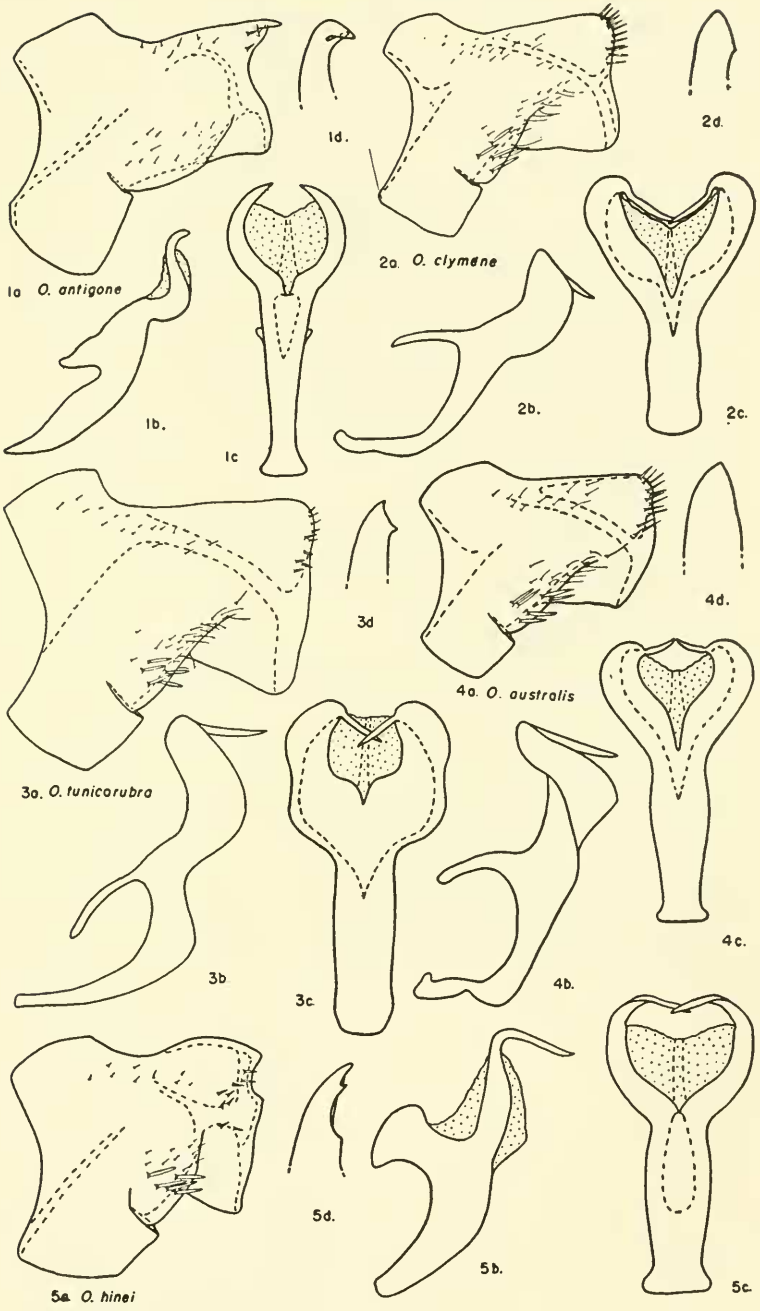

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PLATE LXXVIII

FIG. 1. *Ossiannilssonola bangsoni* sp. nov.
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Left side of pygofer, dorsal angle, posterior aspect.
- 1e. Apex of right style, ventral aspect.

FIG. 2. *Ossiannilssonola duplicata* (McAtee)
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 3. *Ossiannilssonola serrula* (Ross and DeLong)
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 4. *Ossiannilssonola mcateei* sp. nov.
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.
- 4d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 5. *Ossiannilssonola danae* (McAtee)
- 5a. Left side of pygofer, lateral aspect.
- 5b. Aedeagus, left lateral aspect.
- 5c. Aedeagus, posterior aspect.
- 5d. Left side of pygofer, dorsal angle, posterior aspect.
- 5e. Apex of right style, ventral aspect.

PLATE LXXVIII

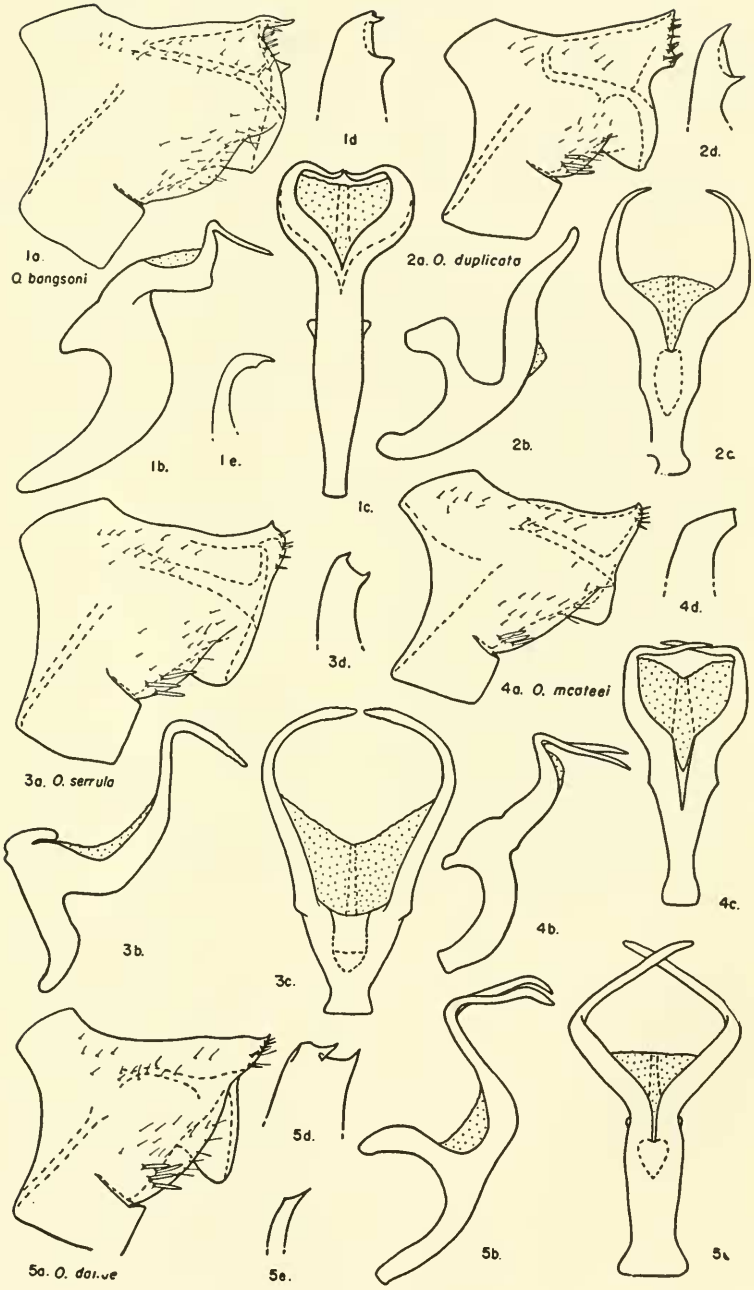


PLATE LXXIX

FIG. 1. *Ossiannilssonola appendiculata* (Malloch)
- 1a. Left side of pygofer and left plate, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Left side of pygofer, dorsal angle, posterior aspect.
- 1e. Right style, ventral aspect.
- 1f. Left plate, ventral aspect.

FIG. 2. *Ossiannilssonola phryne* (McAtee)
- 2a. Left side of pygofer and left plate, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 3. *Ossiannilssonola rossi* sp. nov.
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 4. *Ossiannilssonola knulli* sp. nov.
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.
- 4d. Left side of pygofer, dorsal angle, posterior aspect.
- 4e. Apex of right style, ventral aspect.

PLATE LXXIX

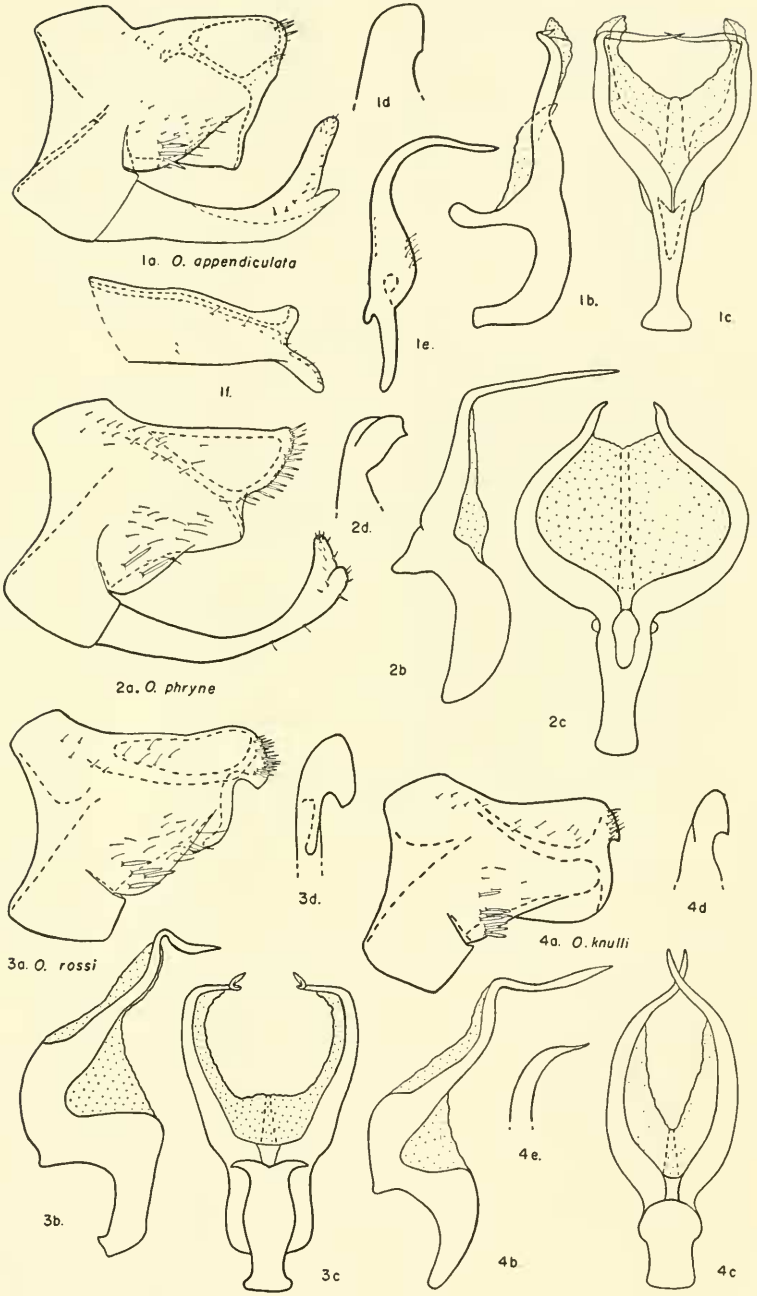

1a. O. appendiculata
1d
1b.
1c
1e.
1f.
2a. O. phryne
2d.
2b
2c
3a. O. rossi
3d.
4a. O. knulli
4d
3b.
3c
4e.
4b
4c

PLATE LXXX

FIG. 1. *Ossiannilssonola troza* (Ross and DeLong)
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Left side of pygofer, dorsal angle, posterior aspect.

FIG. 2. *Ossiannilssonola flavomarginata* (Gillette and Baker)
- 2a. Left side of pygofer and left plate, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Left side of pygofer, dorsal angle, posterior aspect.
- 2e. Right style, ventral aspect.

FIG. 3. *Ossiannilssonola quadrata* (DeLong and Johnson)
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Left side of pygofer, dorsal angle, posterior aspect.
- 3e. Apex of right style, ventral aspect.

PLATE LXXX

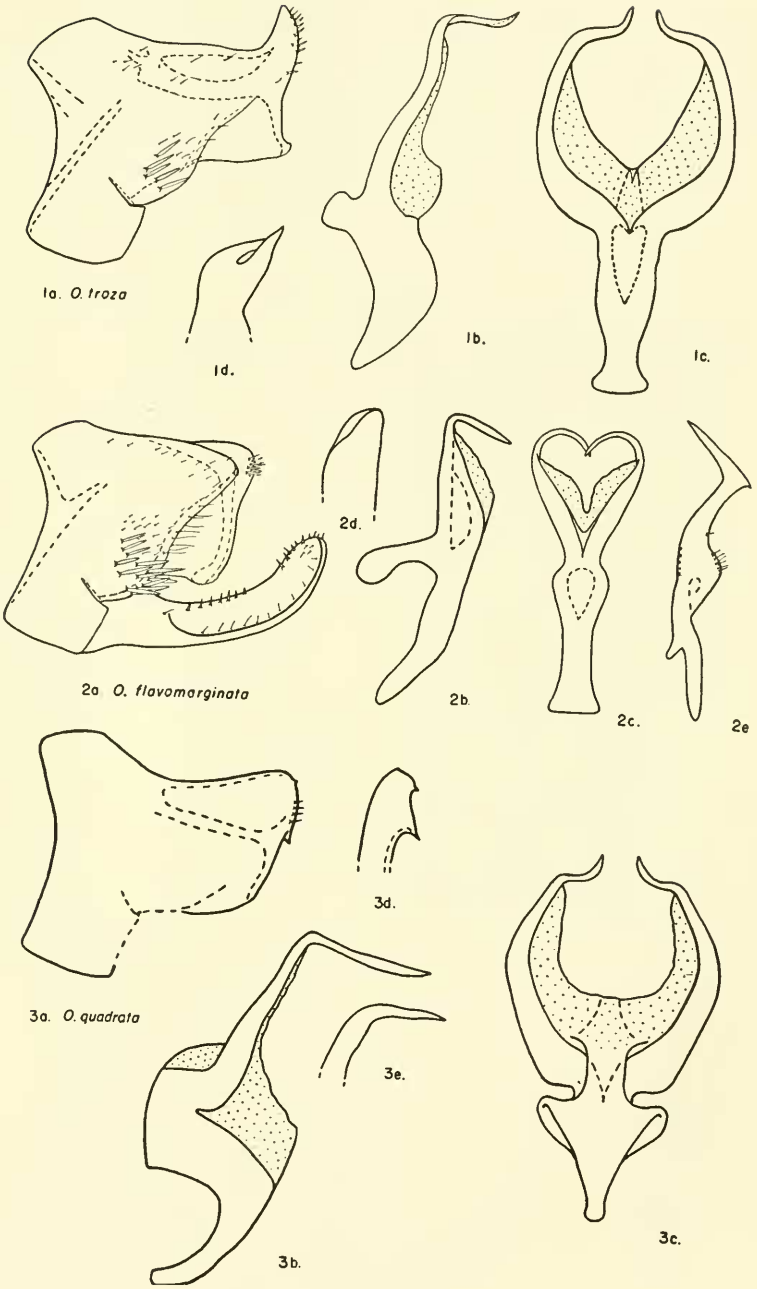

1a. O. troza
1d.
1b.
1c.
2a O. flavomarginata
2d.
2b.
2c.
2e
3a. O. quadrata
3d.
3e.
3b.
3c.

PLATE LXXXI

FIG. 1. *Typhlocyba quercus* (Fabricius)
- 1a. Left side of pygofer and left plate, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.
- 1f. Left fore and hind wing.
- 1g. Head of male and female, dorsal aspect.

FIG. 2. *Typhlocyba oneka* Knull
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Right style, ventral aspect.
- 2e. Connective, ventral aspect.

FIG. 3. *Typhlocyba athene* McAtee
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.

FIG. 4. *Typhlocyba arsinoe* McAtee
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.

PLATE LXXXI

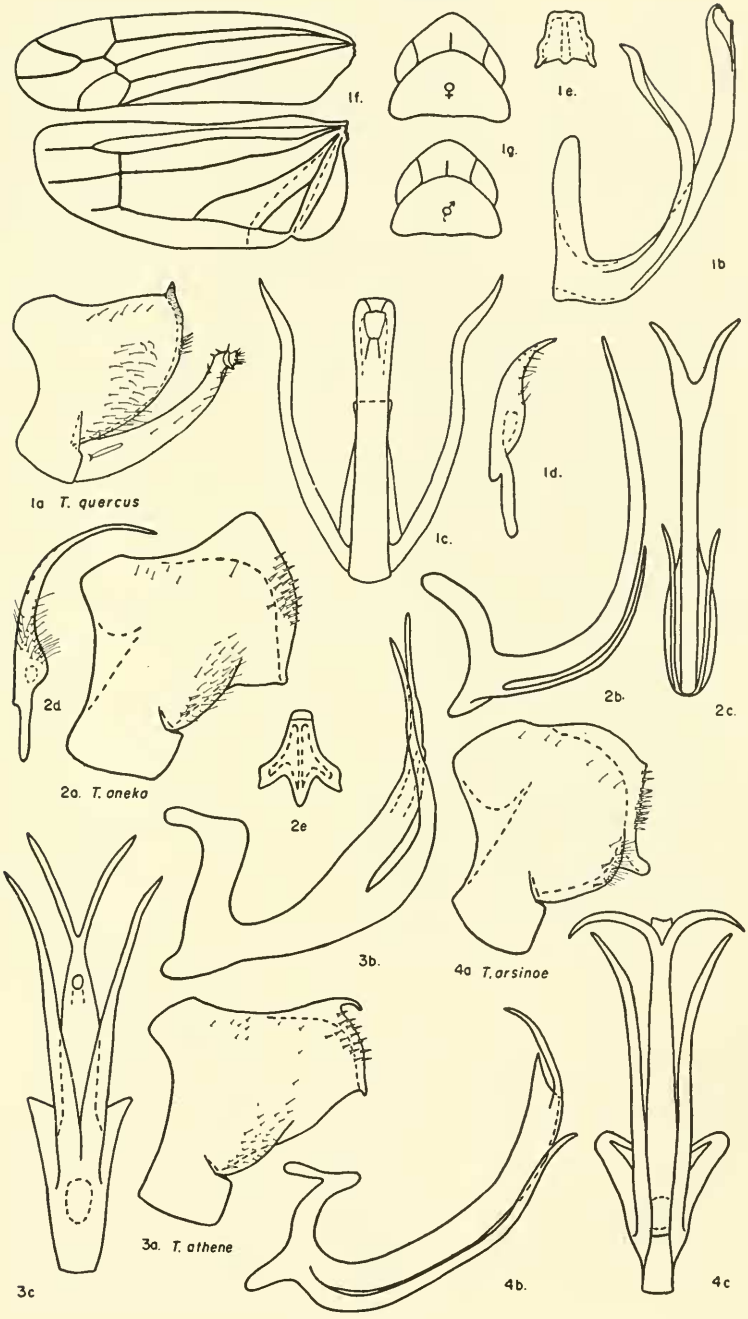

1f.
♀
1g.
♂
1e.
1b
1a T. quercus
1c.
1d.
2b.
2c.
2d.
2a. T. oneka
2e
3b.
4a T. arsinoe
3a. T. athene
3c
4b.
4c

PLATE LXXXII

FIG. 1. *Typhlocyba modesta* Malloch
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.

FIG. 2. *Typhlocyba medleri* sp. nov.
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Right style, ventral aspect.
- 2e. Connective, ventral aspect.

FIG. 3. *Typhlocyba hockingensis* Knull
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Aedeagus, dorsal aspect.
- 3e. Right style, ventral aspect.
- 3f. Connective, ventral aspect.

FIG. 4. *Typhlocyba pomaria* McAtee
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.
- 4d. Right style, ventral aspect.
- 4e. Connective, ventral aspect.

PLATE LXXXII

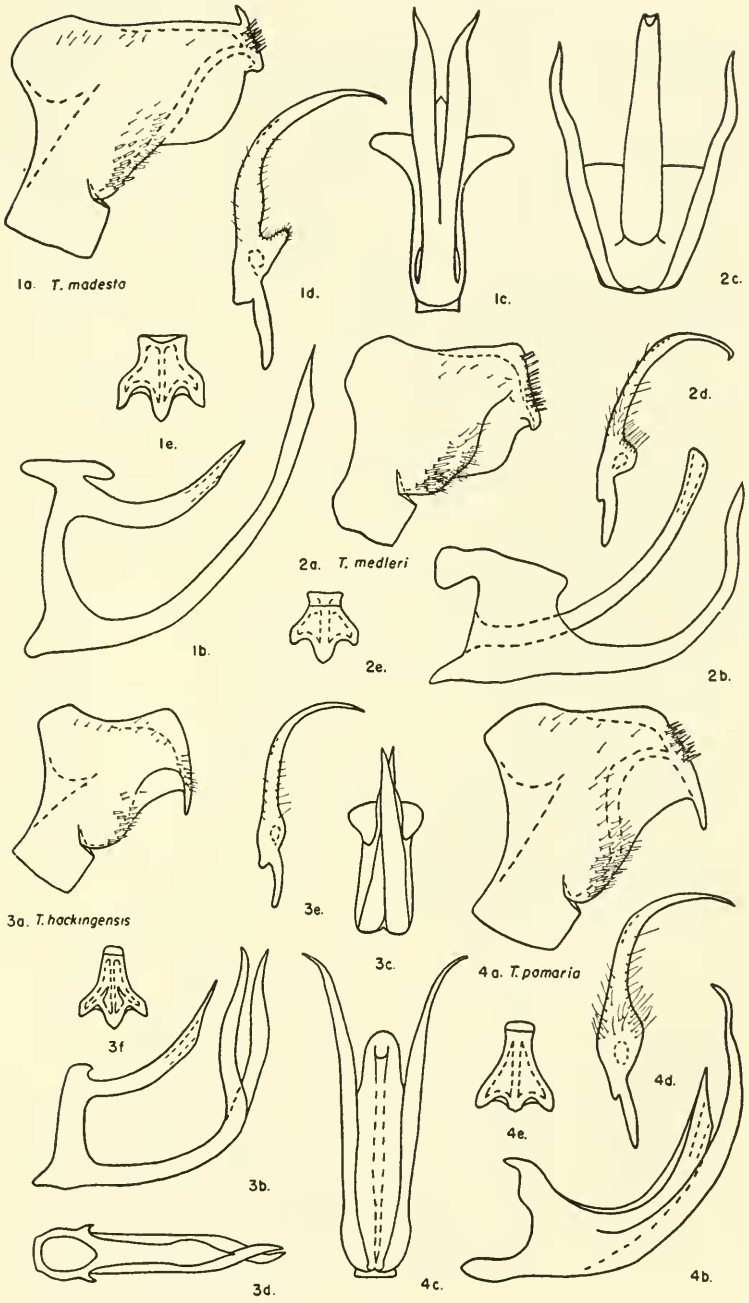


PLATE LXXXIII

FIG. 1. *Typhlocyba attenuata* sp. nov.
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.

FIG. 2. *Typhlocyba rubriocellata* Malloch
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Right style, ventral aspect.
- 2e. Connective, ventral aspect.

FIG. 3. *Typhlocyba surcula* DeLong and Johnson
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Right style, ventral aspect.
- 3e. Connective, ventral aspect.

FIG. 4. *Typhlocyba andromache* McAtee
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.
- 4d. Right style, ventral aspect.
- 4e. Connective, ventral aspect.

PLATE LXXXIII

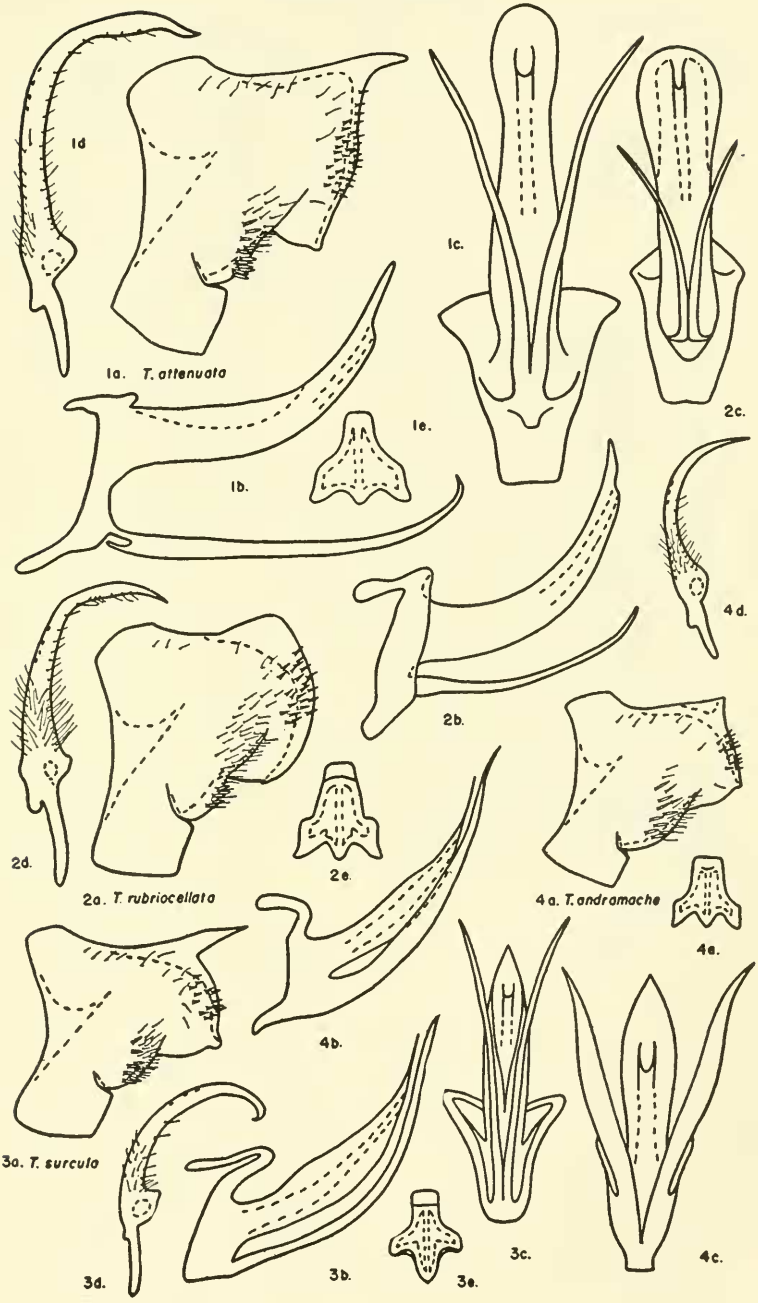


PLATE LXXXIV

FIG. 1. *Typhlocyba melite* McAtee
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.

FIG. 2. *Typhlocyba alabamaensis* sp. nov.
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.

FIG. 3. *Typhlocyba shawneeana* Knull
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Right style, ventral aspect.

FIG. 4. *Typhlocyba transviridis* sp. nov.
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.
- 4d. Right style, ventral aspect.

PLATE LXXXIV

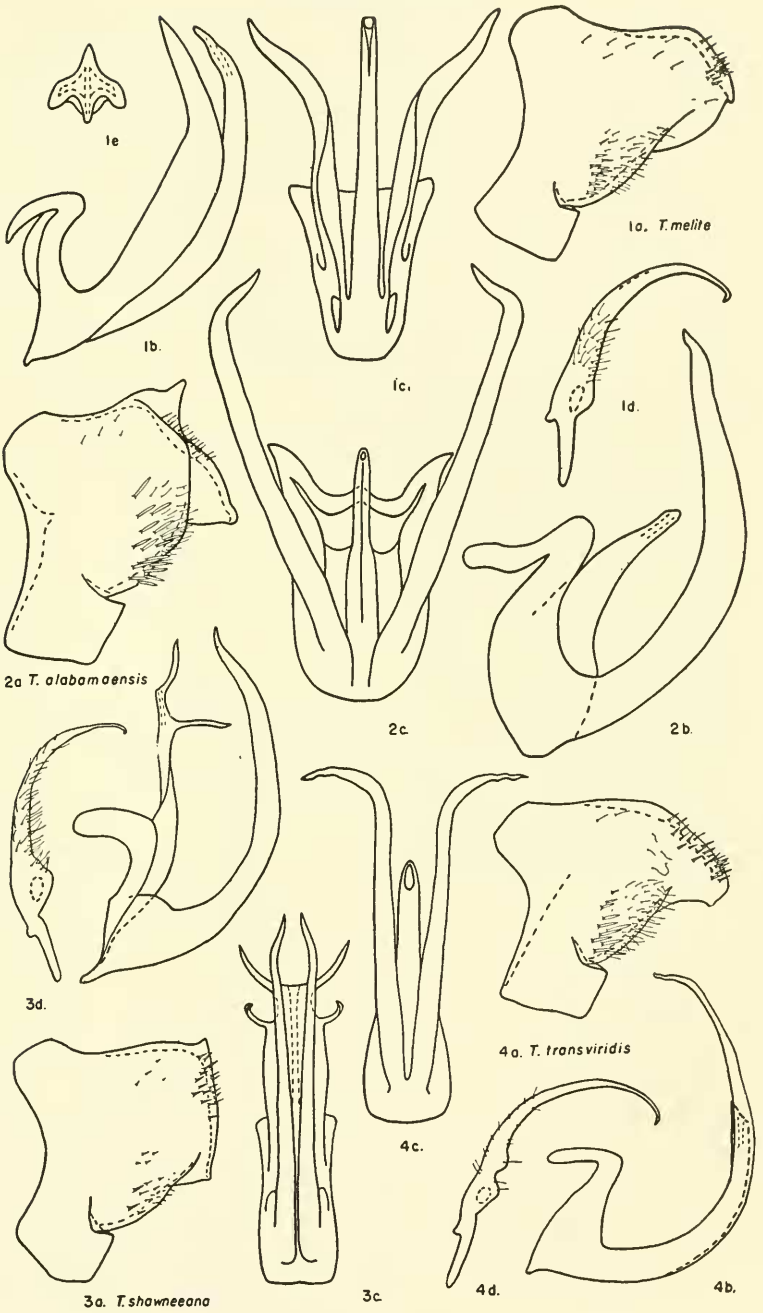


PLATE LXXXV

FIG. 1. *Typhlocyba putmani* Knull
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.

FIG. 2. *Typhlocyba cassiopeia* Knull
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Right style, ventral aspect.
- 2e. Connective, ventral aspect.

FIG. 3. *Typhlocyba crassa* DeLong and Johnson
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Right style, ventral aspect.
- 3e. Connective, ventral aspect.

PLATE LXXXV

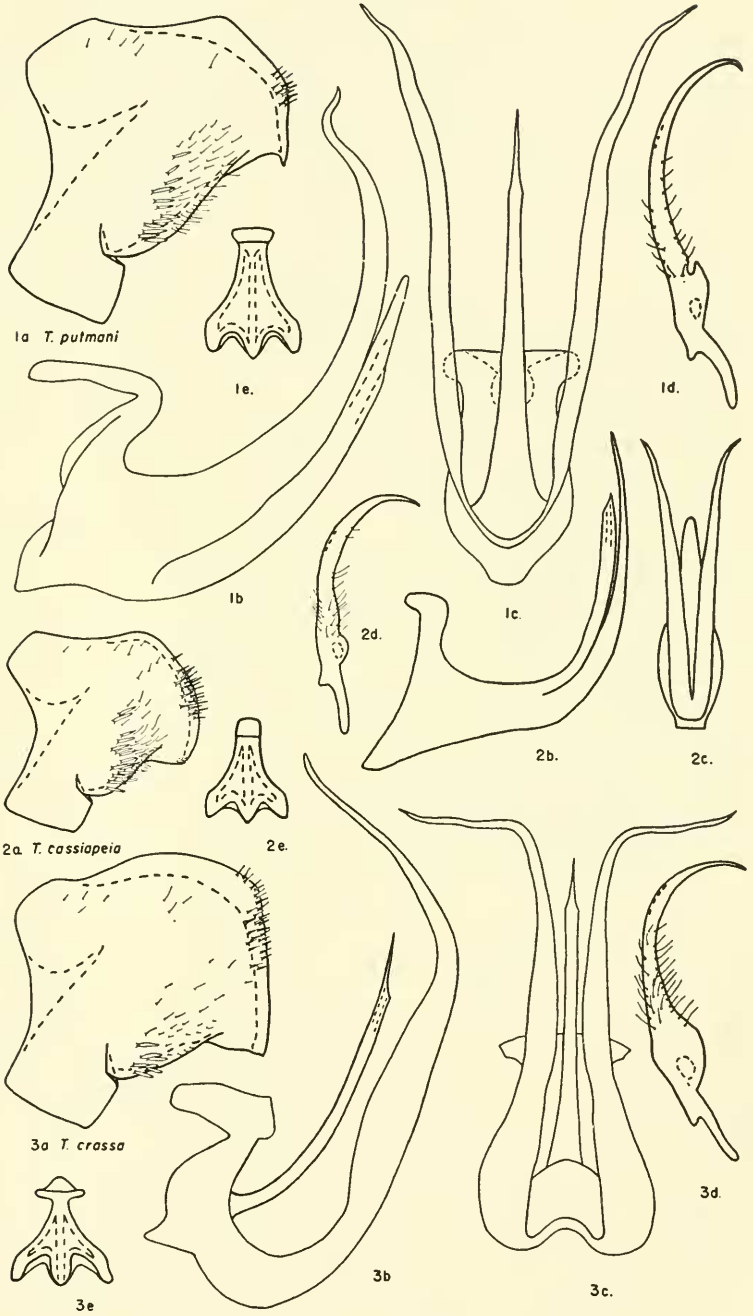

1a T. putmani
1e.
1b
1c.
1d.
2d.
2b.
2c.
2a. T. cassiopeia
2e.
3a T. crassa
3e
3b
3c.
3d.

PLATE LXXXVI

FIG. 1. *Typhlocyba sollisa* Ross and DeLong
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.

FIG. 2. *Typhlocyba tortosa* Ross and DeLong
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Right style, ventral aspect.

FIG. 3. *Typhlocyba persephone* McAtee
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Right style, ventral aspect.
- 3e. Right style, apex, lateral aspect.
- 3f. Right style, apex, posterior aspect.
- 3g. Connective, ventral aspect.

FIG. 4. *Typhlocyba niobe* McAtee
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, posterior aspect.

PLATE LXXXVI

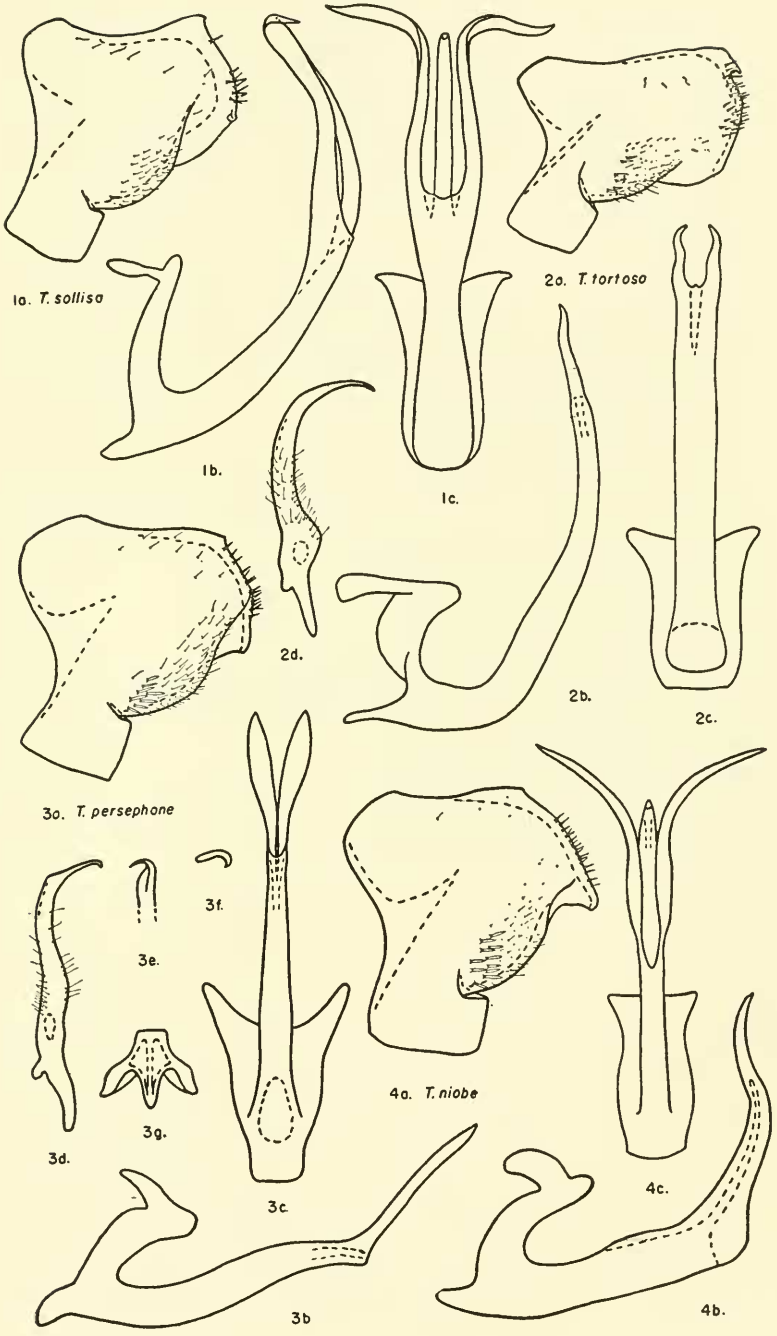


PLATE LXXXVII

FIG. 1. *Typhlocyba inflata* sp. nov.
1a. Left side of pygofer, lateral aspect.
1b. Aedeagus, left lateral aspect.
1c. Aedeagus, posterior aspect.
1d. Right style, ventral aspect.
1e. Connective, ventral aspect.
FIGS. 2-13: Eighth abdominal sternite, female. a. Ventral, b. Lateral aspect.
FIG. 2. *Henribautia nigricephala* (Beamer)
FIG. 3. *Ribautiana piscator* (McAtee)
FIG. 4. *Ribautiana ulmi* (Linnaeus)
FIG. 5. *Mcatecana sexnotata* (Van Duzee)
FIG. 6. *Ossiannilssonola berenice* (McAtee)
FIG. 7. *Ossiannilssonola flavomarginata* (Gillette and Baker)
FIG. 8. *Typhlocyba quercus* (Fabricius)
FIG. 9. *Typhlocyba attenuata* sp. nov.
FIG. 10. *Typhlocyba persephone* McAtee
FIG. 11. *Typhlocyba modesta* Gibson
FIG. 12. *Typhlocyba pomaria* McAtee
FIG. 13. *Edwardsiana rosae* (Linnaeus)

PLATE LXXXVII

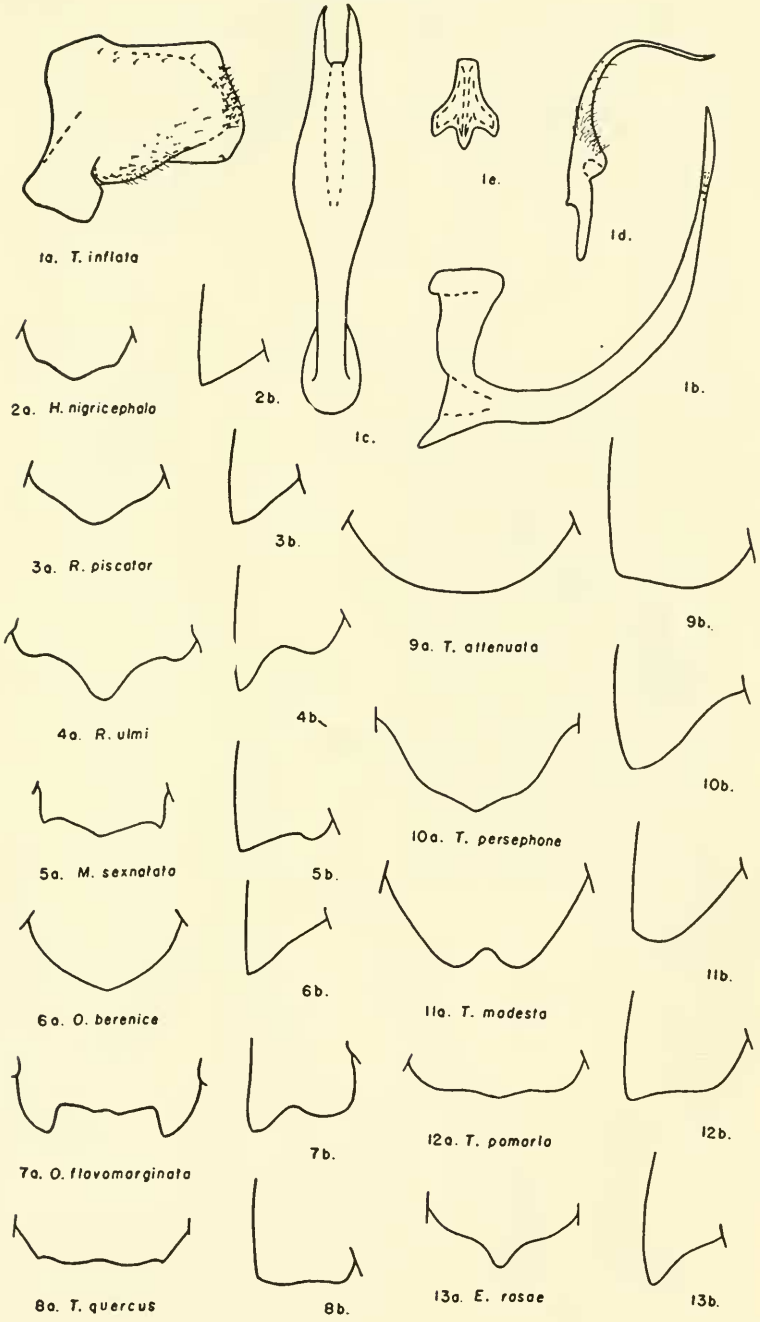


PLATE LXXXVIII

FIG. 1. *Empoa albicans* Walsh
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, posterior aspect.
- 1d. Right style, ventral aspect.
- 1e. Connective, ventral aspect.

FIG. 2. *Empoa spinosa* (Beamer)
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, posterior aspect.
- 2d. Right style, ventral aspect.
- 2e. Connective, ventral aspect.

FIG. 3. *Empoa querci* Fitch
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, posterior aspect.
- 3d. Right style, ventral aspect.
- 3e. Connective, ventral aspect.

PLATE LXXXVIII

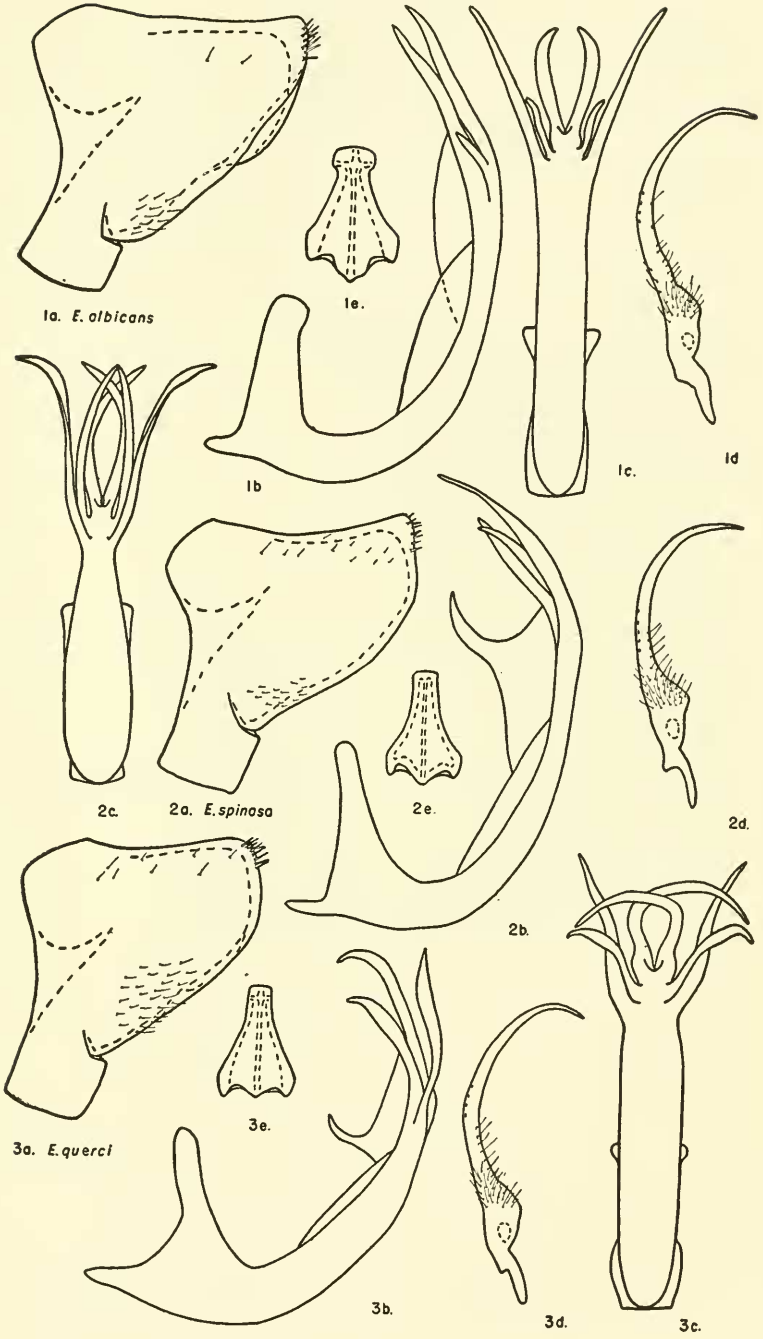


PLATE LXXXIX

FIG. 1. *Edwardsiana lethierryi* (Edwards)
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, anterior aspect.

FIG. 2. *Edwardsiana rosae* (Linnaeus)
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, anterior aspect.
- 2d. Right style, ventral aspect.
- 2e. Connective, ventral aspect.
- 2f. Apex of aedeagus, left lateral aspect, *rosae* variation.
- 2g. Apex of aedeagus, anterior aspect, *rosae* variation.

FIG. 3. *Edwardsiana bergmani* var. *ariadne* (McAtee)
- 3a. Left side of pygofer, lateral aspect, (Maine specimen).
- 3b. Aedeagus, left lateral aspect, (Maine specimen).
- 3c. Aedeagus, anterior aspect, (Maine specimen).
- 3d. Left side of pygofer, lateral aspect, (Montana specimen).
- 3e. Aedeagus, left lateral aspect, (Montana specimen).
- 3f. Aedeagus, anterior aspect, (Montana specimen).

FIG. 4. *Edwardsiana bergmani* var. *bergmani* (Tullgren)
- 4a. Aedeagus, left lateral aspect, (Swedish specimen).
- 4b. Aedeagus, anterior aspect, (Swedish specimen).

PLATE LXXXIX

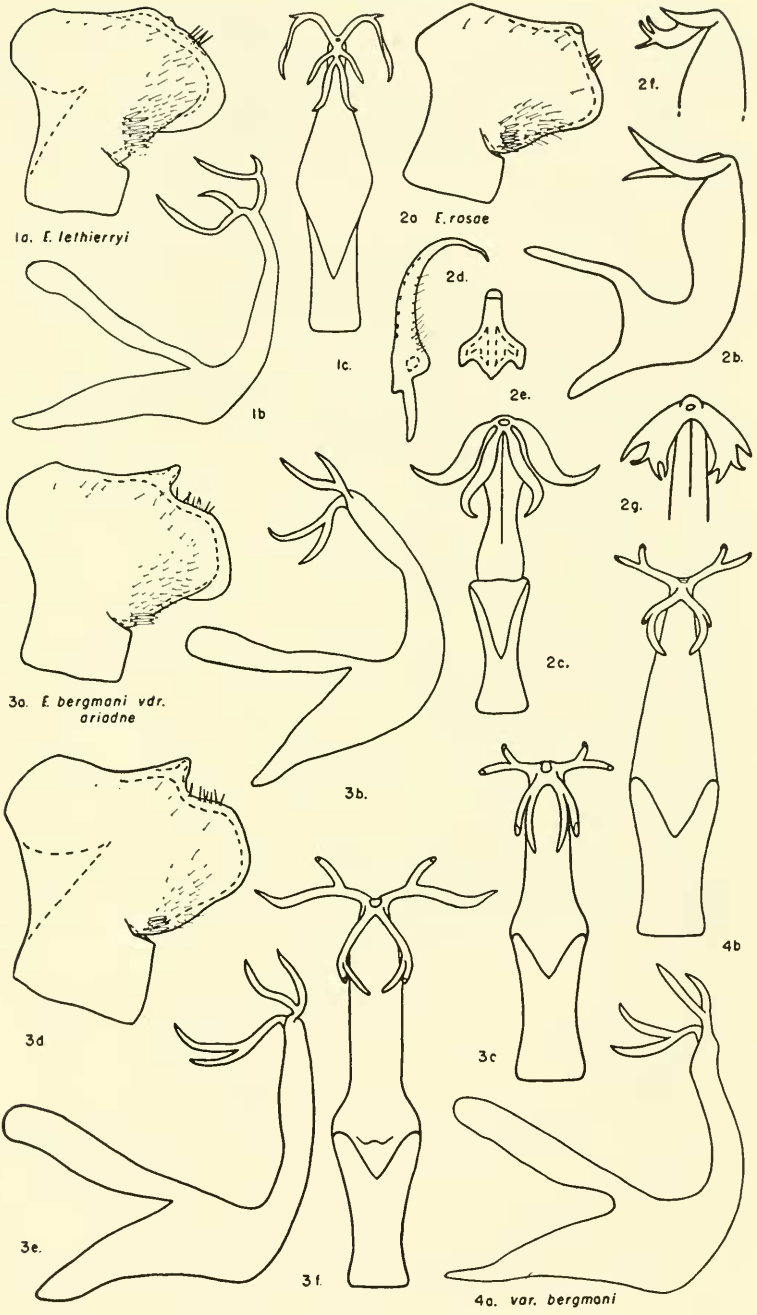


PLATE XC

FIG. 1. *Edwardsiana expanda* (DeLong and Johnson)
- 1a. Left side of pygofer, lateral aspect.
- 1b. Aedeagus, left lateral aspect.
- 1c. Aedeagus, anterior aspect.
- 1d. Apex of aedeagus, left lateral aspect (abnormal specimen).

FIG. 2. *Edwardsiana frustrator* (Edwards)
- 2a. Left side of pygofer, lateral aspect.
- 2b. Aedeagus, left lateral aspect.
- 2c. Aedeagus, anterior aspect.

FIG. 3. *Edwardsiana plebeja* (Edwards)
- 3a. Left side of pygofer, lateral aspect.
- 3b. Aedeagus, left lateral aspect.
- 3c. Aedeagus, anterior aspect.

FIG. 4. *Edwardsiana prunicola* (Edwards)
- 4a. Left side of pygofer, lateral aspect.
- 4b. Aedeagus, left lateral aspect.
- 4c. Aedeagus, anterior aspect.

FIG. 5. *Edwardsiana candidula* (Kirschbaum)
- 5a. Left side of pygofer, lateral aspect.
- 5b. Aedeagus, left lateral aspect.
- 5c. Aedeagus, anterior aspect.

FIG. 6. *Edwardsiana australis* (Froggatt)
- 6a. Left side of pygofer, lateral aspect.
- 6b. Aedeagus, left lateral aspect.
- 6c. Aedeagus, anterior aspect.

PLATE XC

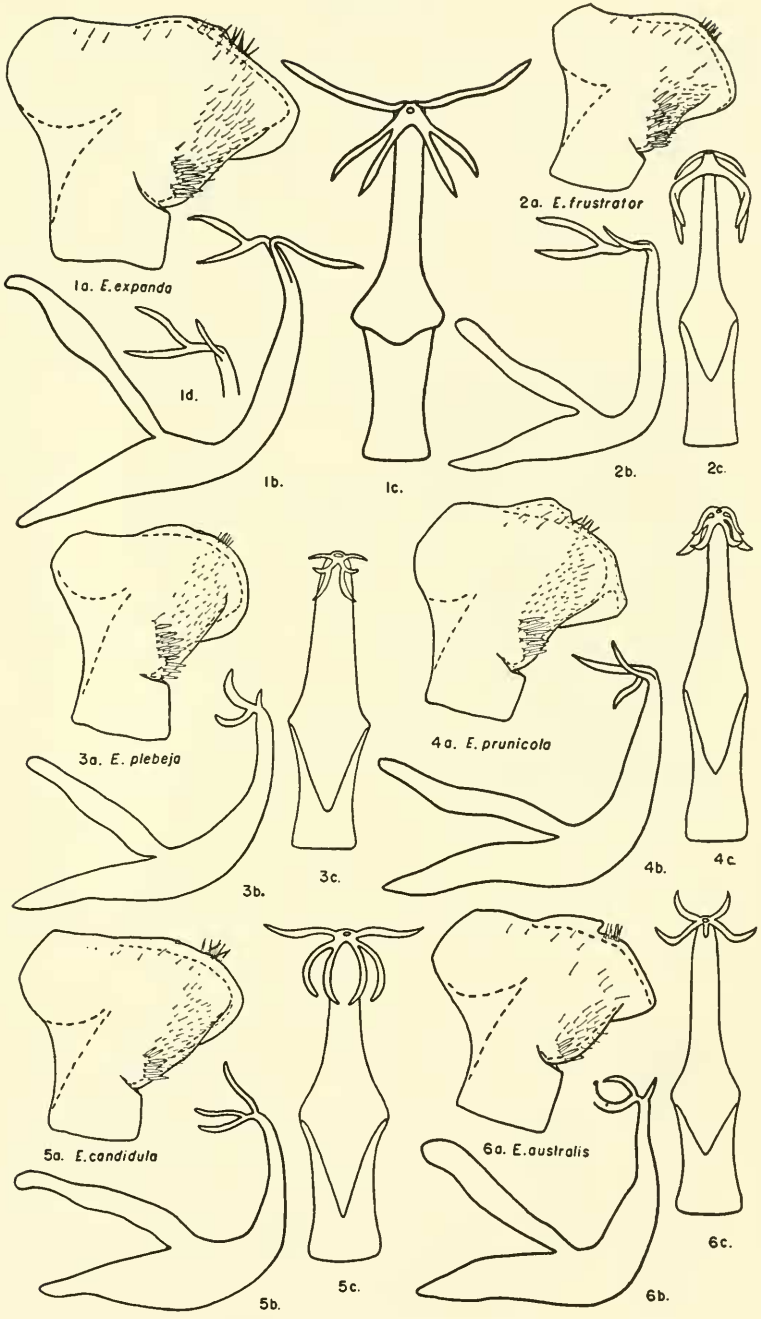

1a. E. expanda
1d.
1b.
1c.
2a. E. frustrator
2b.
2c.
3a. E. plebeja
3b.
3c.
4a. E. prunicola
4b.
4c
5a. E. candidula
5b.
5c.
6a. E. australis
6b.
6c.

PLATE XCI

FIG. 1. *Edwardsiana projecta* sp. nov.
1a. Left side of pygofer, lateral aspect.
1b. Aedeagus, left lateral aspect.
1c. Aedeagus, anterior aspect.
1d. Aedeagus, apex, posterodorsal aspect.
FIG. 2. *Edwardsiana pseudocommissuralis* sp. nov.
2a. Left side of pygofer, lateral aspect.
2b. Aedeagus, left lateral aspect.
2c. Aedeagus, anterior aspect.
FIG. 3. *Edwardsiana dejecta* sp. nov.
3a. Left side of pygofer, lateral aspect.
3b. Aedeagus, left lateral aspect.
3c. Aedeagus, anterior aspect.
FIG. 4. *Edwardsiana dorsti* (Ossiannilsson)
4a. Left side of pygofer, lateral aspect.
4b. Aedeagus, left lateral aspect.
4c. Aedeagus, anterior aspect.

PLATE XCI

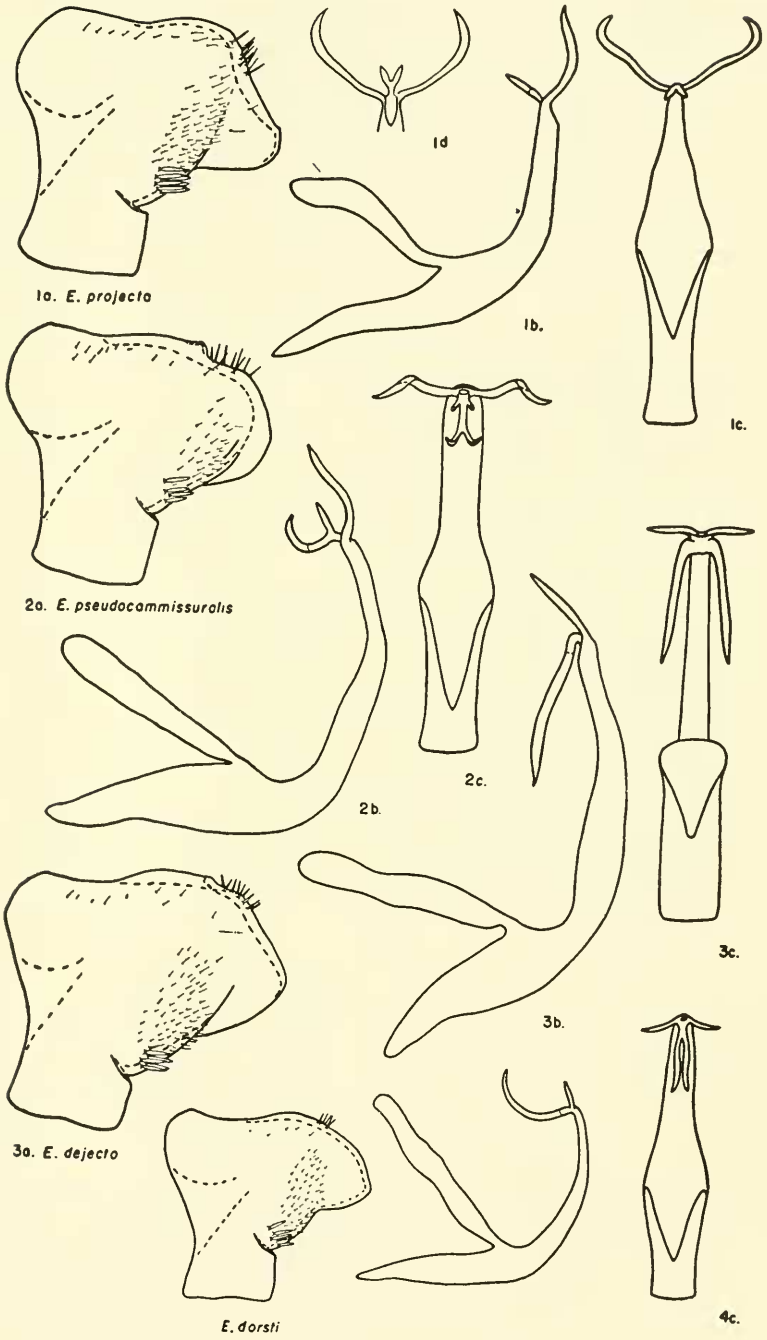
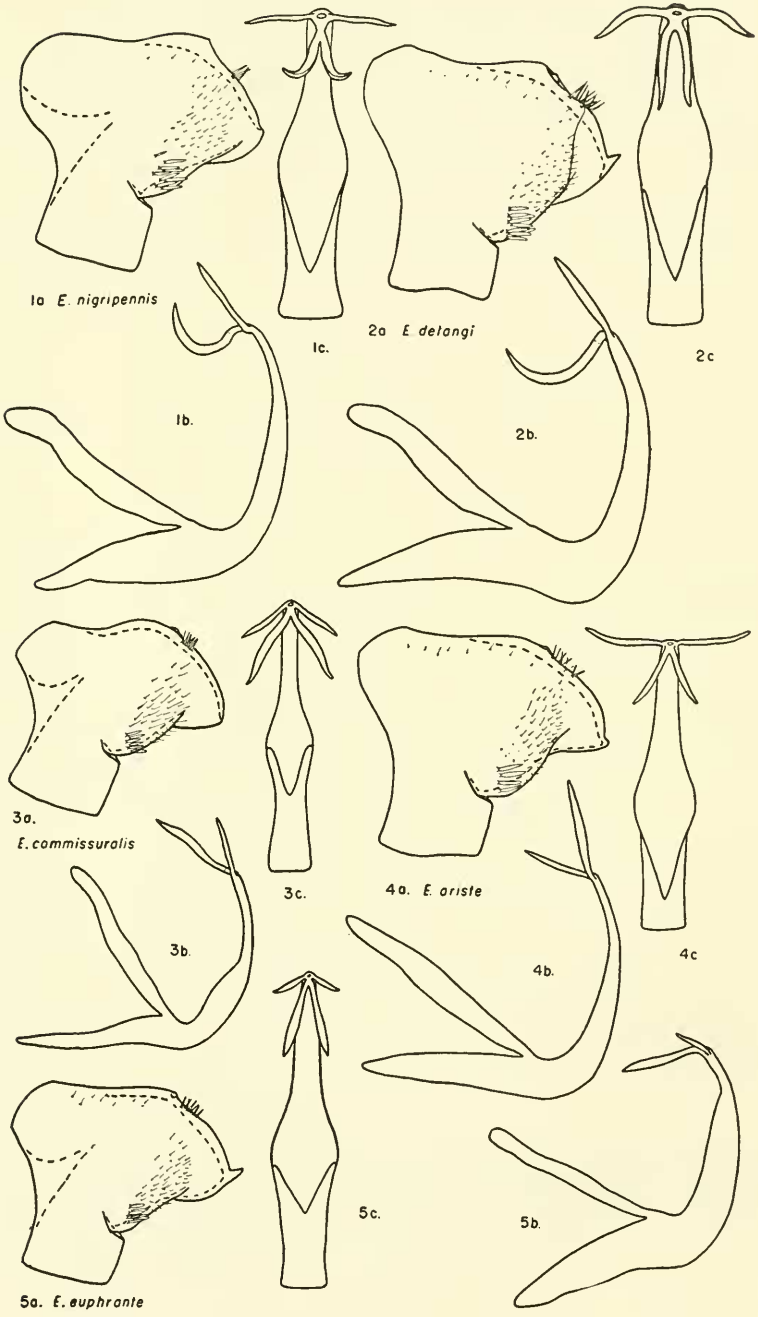

1a. E. projecta
1d
1b.
1c.
2a. E. pseudocammissuralis
2c.
2b.
3c.
3b.
3a. E. dejecto
E. dorsti
4c.

PLATE XCII

FIG. 1. *Edwardsiana nigripennis* sp. nov.
1a. Left side of pygofer, lateral aspect.
1b. Aedeagus, left lateral aspect.
1c. Aedeagus, anterior aspect.
FIG. 2. *Edwardsiana delongi* sp. nov.
2a. Left side of pygofer, lateral aspect.
2b. Aedeagus, left lateral aspect.
2c. Aedeagus, anterior aspect.
FIG. 3. *Edwardsiana commissuralis* (Stål)
3a. Left side of pygofer, lateral aspect.
3b. Aedeagus, left lateral aspect.
3c. Aedeagus, anterior aspect.
FIG. 4. *Edwardsiana ariste* (McAtee)
4a. Left side of pygofer, lateral aspect.
4b. Aedeagus, left lateral aspect.
4c. Aedeagus, anterior aspect.
FIG. 5. *Edwardsiana euphrante* (McAtee)
5a. Left side of pygofer, lateral aspect.
5b. Aedeagus, left lateral aspect.
5c. Aedeagus, anterior aspect.

PLATE XCII


1a E. nigripennis
1c.
1b.
2a E. delongi
2c
2b.
3a.
E. commissuralis
3c.
3b.
4a. E. oriste
4c
4b.
5a. E. euphrante
5c.
5b.